



REPUBLIC OF SOUTH AFRICA

Report of the Secretary for Agricultural

ANNUAL REPORT

1st July, 1973, to 30th June, 1974

of the

**Secretary for
Agricultural Technical Services
for the period
1 July, 1973 to 30 June, 1974**

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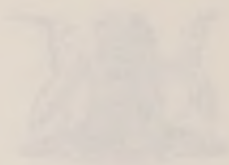
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for the period

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THE HONOURABLE THE MINISTER OF AGRICULTURE,
P R E T O R I A

Sir,

I have the honour to submit herewith the Annual Report of the Department.

W.A. VERBEEK

Secretary for Agricultural Technical Services

CONTENTS

	Pa
1. INTRODUCTION	1
2. EXTENSION AND EDUCATION	4
Agricultural Extension	4
Agricultural Education	22
Publications	24
Audio-visual Services, Calling All Farmers	25
Library Service	25
3. NATURAL RESOURCES	27
Mapping of Land Types, Agricultural Meteorology	27
Irrigation Planning	27
Soil Conservation	27
Catchments	30
Subdivision of Agricultural Land Act	30
Soil Fertility Studies	30
Use of Fertiliser	30
Other Soil and Water Studies	30
Analytical Services	40
Natural Grazing	40
Bush Encroachment	42
Veld Weeds	44
Poisonous Veld Plants	46
4. FIELD HUSBANDRY	47
Maize	47
Wheat	48
Cotton	53
Chicory	54
Pyrethrum, Buckwheat, Oats, Barley	55
Potatoes	56
Tobacco	58
Grain sorghum	63
Soya-beans, Dry Beans, Groundnuts	64
Sunflower Seed	65
Artificial Pastures and Forage Crops	66

	Page
5. HORTICULTURE	71
Deciduous Fruit	71
<i>Winter Rainfall Region</i>	71
<i>Summer Rainfall Region</i>	76
Table Grapes	78
<i>Winter Rainfall Region</i>	78
<i>Summer Rainfall Region</i>	80
Wine Grapes	81
Citrus	90
Subtropical Fruit	94
Vegetables	99
Nuts	105
Strawberries	107
Flowers	108
Coffee	110
Tea	111
6. ANIMAL SCIENCE	112
Beef Cattle	112
Dairying	115
Sheep and Wool	119
Angora Goats	122
Boer Goats	123
Pigs	124
Fowls	125
Ducks, Ostriches	126
Horses, Game	127
7. VETERINARY SERVICES	129
Introduction	129
Notifiable Diseases	130
Non-notifiable Diseases	135
Bacterial Diseases	135
Protozoal Diseases	138
Virus Diseases	139
Infertility and Venereal Diseases	141
Diseases of Calves	143
Deficiency and Nutritional Diseases	144
Poisoning	145

	Page
Internal Parasites, External Parasites	147
Basic Veterinary Research	149
Vaccine Production	149
Diagnostic Services	151
Surveys, A.I.	152
Health Schemes, Meat Hygiene	154
Stock Inspection Services, Import Control	155
Export Control	156
Training, Legislation	157
Technical Relations with Other Countries	157
Stock Census	158
8. AGRICULTURAL ENGINEERING	161
Testing of Agricultural Implements	161
Agricultural Mechanisation Development	161
Farm Buildings and Structures	163
Water Utilisation	163
Agricultural Engineering Extension	163
Soil Conservation	166
Professional and Technical Services	166
9. ADDITIONAL SERVICES	170
Plant Studies	170
Plant and Seed Control	170
National Collection of Insects	187
Control of Other Animal Pests	190
Insect Control and Research	190
Beneficial Insects	192
Mycology	193
Legume Research	194
Agricultural Technical Relations with Foreign Countries	195
Administrative Matters	202
10. ANNEXURES	208
Organisation and Function of the Department	208
Finances	214
Scientific Publications	216
Leaflets	228
Non-departmental Publications	230
New Legislation	232

COVER

The fibre strength of citrus fruit is measured with this new apparatus used by the Citrus and Subtropical
Fruit Research Institute

1. Introduction

AGRICULTURAL RESEARCH

The object of the Department of Agricultural Technical Services is to promote agricultural development, which is aimed at optimal agricultural production and the protection of the natural agricultural resources.

Some of the ways in which this function is fulfilled are the determination of the production potential of the various agro-ecological areas, the stabilisation of agricultural production through adapted farming systems and methods, the development of individual agricultural industries and the protection of agricultural resources, plants and animals.

The promotion of agriculture has come to depend to an increasing extent on a scientific understanding of the fundamental problems and the technological knowledge that is needed to solve those problems. Therefore research has to point the way for agricultural development and indicate how to proceed along that way. Research is therefore one of the main avenues by which the Department approaches its task, both for the acquisition of knowledge to solve recognised problems and for the opening up of unexplored possibilities of production.

The Department's research action consists largely in work which has a practical application in agriculture and often relates to specific environments. However, if it is necessary to delve deeper to reach the core of a problem research of a more fundamental nature is undertaken. Such projects often require expensive, sophisticated equipment and scientists who have specialised in particular fields. Such research, which does not relate to any particular environment, is therefore undertaken at national institutes or centres in order to prevent duplication or repetition and so make the best possible use of manpower and funds.

The organisation of research activities

The need for national research centres specialising in various field crop and livestock industries has become apparent. For each such industry a main centre has therefore been designated, with a nucleus of staff devoting their full attention to the investigation of problems affecting that particular industry. This arrangement not only prevents the undesirable situation of having everyone trying to do everything everywhere,

but also makes evaluation and adaptation tests in the various areas easier and more effective because thorough background work has already been done at the specialist level. Good progress has already been made towards giving final shape to the better deal that is envisaged for the various agricultural industries.

During the year under review particular attention was paid to the Department's research programme. Matters that were subjected to close scrutiny were the question of whether projects had clearly defined objectives, the question of priorities for programmes, and possible duplication or repetition of activities. The functions of the various institutes, regional organisations and divisions were reviewed and defined, and at the same time attempts were made to improve channels of communication. Because of the Department's very wide range of activities internal communications are of the utmost importance.

The research undertaken by the Department is not only the most extensive in the Republic, but also involves the widest variety of disciplines. Any individual project is usually part of a wider programme aimed at the attainment of a goal of a higher order. Consequently it is not the liaison between the various institutions which is of great importance, but also the liaison and consultation between scientists in different disciplines. Several teams were formed in order to promote co-ordinated action. Together the members of a team undertake a broader programme and those members not only represent one or more disciplines, but often they are also attached to different institutions. In this way the separate aspects are meaningfully linked up with the national programme.

For example, the programme for the promotion of red meat production is not a one-sided attempt by animal scientists from only one institution; animal scientists from various institutions, as well as nutritionists, veterinarians, pasture scientists and economists, are participating in the programme. Concerted action of this kind means that any project is tackled from every possible angle.

Agricultural research is a long-term investment

Money spent on research sometimes produces quick results, but more often turns out to be an investment for the future. During the year under review good progress was made with agricultural resource surveys which will serve as a foundation for future area development. For instance, the study of the

ground-water status on the Vaalharts Scheme and the survey on the irrigability of State land in the Fish River Valley were completed.

Research results do not always have an immediate application. The fruits of research are often enjoyed only after a number of years. The inoculant against elephant skin disease in cattle which was released by the Veterinary Research Institute during the year under review, for instance, is the fruit of research carried on for several years. This inoculant is unique in that it is the first inoculant against a protozoic disease to be prepared in tissue culture.

Research on wine chemistry has been in progress for years at the Oenological and Viticultural Research Institute. This research led to a recent break-through of world-wide importance in these laboratories when the aroma component characteristic of good quality late harvest wines was isolated and identified. This break-through is a positive step forward in the development of a more objective method of judging the quality of wines.

It is not possible to develop a new improved cultivar of an agricultural crop within a year or two. It generally takes from ten to fifteen years of concentrated work on a breeding programme before results can be expected. It is therefore gratifying to be able to report that the plant improvement programmes of the Department yielded such good results again during the year under review.

The improved material supplied to the South African agricultural industry included improved gem squashes that do not turn yellow for up to three months, disease-resistant air-cured and burley tobacco, improved wheat cultivars, new peach varieties included a yellow-fleshed loose-stone cultivar, and virus-free planting material of various strawberry, grape, cherry, sweet potato and rose cultivars.

The improvement of agricultural crops through the breeding of new cultivars and the improvement of the existing ones remains an important function of the Departmental institutions established for the various industries. Breeding lines of wine and table grapes, citrus, bananas, wheat, maize, groundnuts, soya-beans and sunflowers at present being evaluated are expected to produce material for release shortly.

The campaign against animal and plant diseases continued non-stop. The production of vaccines against animal diseases reached a new record level during the year under review, when 152 509 615 doses were produced. There has been a great advance in the field of plant protection — ecological research has shown that the integration of chemical and biological measures can reduce the cost of pest control considerably.

Carefully planned and properly organised research can often anticipate problems and often solutions before the problems have become serious. A striking example of such preparedness is the study and research the Department has undertaken since 1971 on the maize disease, southern leaf blight *Helminthosporium maydis*. This disease caused serious losses of maize in the United States of America in 1970. Although the Department regards the appearance of this potentially dangerous maize disease in South Africa in April 1974 in a very serious light, it is confident that, thanks to the information obtained since 1971, it will be possible to contain the disease here before it reaches very serious proportions.

Agricultural problems are often of a biological nature, and relating to a particular environment. Consequently it is not possible simply to take knowledge over from overseas sources. On the other hand, adjustments have to be made in a rapidly developing country like South Africa, if we are to keep pace with both local and overseas requirements. It is therefore necessary to keep abreast of overseas developments in the agricultural sciences. In this respect the Agricultural Counsellors in Paris, London, Washington, Canberra and Buenos Aires play an important part in keeping local agriculturists informed of the latest developments in agricultural technology overseas.

Visits to South Africa by overseas experts and visits to overseas countries by officers of the Department were again a means of exchanging and disseminating scientific knowledge. Valuable contributions were made by the visits of Professor C.O. Grongon of Cornell University, a world authority on maize-breeding, Professor E.C. Maxie, a world-famous pomologist, and Dr R.J. Weaver, a Professor of Oenology, both from the University of California, Dr M.V. Carter and Mr M. Bumbieris, plant pathologists from the Waite Agricultural Research Institute in Australia, Dr J. Crosse, a world-famous bacteriologist who is attached to the East Malling Research Institute in England, Professor G.E. Lamming, Professor of Animal Physiology at the University of Nottingham, Dr Martin Prevel, head of the Plant Physiology Division of the I.F.A.C. in France, and Dr Norman Borlaug, to whom the Nobel Peace Prize for 1970 was awarded for his contribution to increased world food production through his achievements in wheat breeding.

Co-ordination of knowledge

The Department of Agricultural Technical Services can only do justice to its task of taking the lead in agricultural research and extension and co-ordinating services if it receives the wholehearted co-operation and support of the many bodies concerned with agricultural production. Because South Africa is a country of extremes and the limited number of trained

agriculturists, it is of the utmost importance that the available manpower should be used as efficiently as possible. Co-operation between the Department of Agricultural Technical Services and all the bodies which provide technical services for farmers can contribute a great deal in this connection.

With organisations run on a profit basis there is healthy co-operation as regards the exchange of scientific knowledge, but when it comes to the performance of services uniform action is not so easy to achieve. It must be accepted that with such bodies financial interests are the overriding consideration.

There should, however, be the closest possible co-operation with organisations where the service motive is the primary one. The Department co-operates fully with Organised Agriculture, the control boards, other Government departments, agricultural co-operatives and the universities with regard to research and extension work undertaken in the interests of agriculture. Liaison is made possible by advisory committees for the principal agricultural industries on which directly interested bodies are represented, and by committees which provide liaison with Organised Agriculture. The same applies to research stations. The Department is represented on most control boards in an advisory capacity, and meetings of interest groups in Organised Agriculture are regularly attended.

The Citrus Improvement Programme is a joint project of the Department and the South African Co-operative Citrus Exchange. Similarly, the technical staff of the South African Stud Book Association are actively involved in the national beef cattle performance testing and pig recording schemes.

Special efforts are at present being made to get lecturers at the Faculties of Agriculture involved in the national research programmes. These efforts are all the more important now that the Faculties of Agriculture are no longer an integral part of the Department. The value of such co-operation again became evident during the year under review when a research worker from the Citrus and Subtropical Fruit Research Institute and a lecturer from the University of Natal, working together, found that the organism that causes greening in citrus is a mycoplasma-like bacterium and not a virus. This was an outstanding achievement.

Dissemination of knowledge

Agricultural research only serves its purpose if the results ultimately help to promote the agricultural industry. For this reason agricultural research cannot be divorced from extension work. The extension service

depends on the research worker for his specialised knowledge of his field or the latest technical knowledge, and the research worker often depends on the extension officer when it comes to problem identification and evaluation.

The results of agricultural research carried out by the Department are published in several scientific journals of the Department, namely *Agroanimalia*, *Agrochemophysica*, *Agroplantae*, *Flowering Plants of Africa*, *Bothalia*, *Flora of Southern Africa*, *The Onderstepoort Journal of Veterinary Research and Phytophylactica*.

The Department is well aware that the findings of agricultural research often require a great deal of adaptation to fit them for application on any particular farm. In order to bring this information to the farmer in a suitable and intelligible form, various pamphlets series have been launched. Good progress has already been made in the preparation of these pamphlet series for most agricultural industries. These series have been so well received that several industries have already started supplying special covers to producers in which the series can be kept for easy reference.

Agricultural training at the six colleges of agriculture is the responsibility of this Department, since it is practical training, based on technology; and those concerned with teaching have to keep in close touch with practice. When it became clear that the one-year diploma course was not supported very well by farmers' sons the two-year courses were introduced again. Since then student numbers, which had dropped in the late sixties, started to rise again. This increase continued during the year under review and has now reached the point where the available accommodation at most colleges of agriculture is being fully utilised. Unremitting attempts are made not only to provide the necessary facilities but also to adapt training to the needs of the particular area and the time.

Besides the formal training at colleges of agriculture which is aimed at training would-be farmers and those who want to serve agriculture in the technical sphere, the Department's education programme also includes numerous short courses, farmers' days, study group activities and a daily radio programme.

Fulfilling the function to the Department requires a combined effort on the part of research workers and extension officers, supported by administrative officers, and by all the regional organisations, institutes and divisions of the Department. The chapters in the body of this report contain particulars of the progress the Department has made in this respect during the year under review.

2. Extension and Education

AGRICULTURAL EXTENSION

Exactly 50 years ago this year the then Government decided to establish a separate extension service on a ward basis for farmers in South Africa.

The driving force behind this decision was Colonel Heinrich du Toit, who felt that the available scientific knowledge did not reach the farmer. He requested the then Minister of Agriculture, Sir Thomas Smartt, to institute a service to give the farmer agricultural advice. The first extension officers were appointed and left for their posts at the beginning of 1925.

Since then the Agricultural Extension Service has grown into a comprehensive service to the farmer. Today modern educational communication techniques are used to ensure that the latest agricultural knowledge is conveyed to the farmer as effectively as possible.

The following list of activities gives a picture of the range of the services rendered to the farming community during the year under review:

Activity	Number	Number of farmers reached
Farmers' days organised by officers of the Department or in which they participated	474	21 045
Lectures given by officers of the Department at farmers' days	770	
Demonstrations given by officers of the Department at farmers' days	195	
Lectures given on occasions other than farmers' days	1 567	34 690
Number of lectures at which visual aids were used	1 108	20 274
Departmental courses held in extension wards	128	3 634
Co-operative demonstrations and projects		
Co-operative demonstrations in progress	244	
Gatherings at demonstration plots	125	1 867
Other agricultural demonstrations	136	1 905
Co-operative research projects laid out during the year	73	
Total number of co-operative research projects in progress	127	

Activity	Number	Number of farmers reached
Farm visits by officers of the Department	67 563	67 563
Follow-up visits in connection with farm planning	8 062	8 062
Personal interviews in extension offices	78 569	78 569
Other personal interviews	16 311	16 311
Telephone interviews	96 642	96 642
Personal letters dispatched	19 867	19 867
Circulars dispatched	631	147 872
Shows held in various extension wards	167	
Officers who acted as judges or supervisors	254	
Exhibitions organised by officers of the Department at shows or other functions	20	
Farming competitions held in extension wards at which officers of the Department adjudicated	118	
Competitors	3 189	
Farms inspected for the Land Bank	38	
Farms inspected for the Department of Agricultural Credit and Land Tenure and the Agricultural Credit Board	1 85	
Farms inspected for the Department of Planning	211	
Farms inspected for other Departments	616	
<i>Inspections in terms of the Weeds Act</i>		
Properties inspected	20 407	
Notices served	958	
Prosecutions instituted	8	
Re-inspections after service of notices	1 218	
<i>Study Groups and Programme Planning Committees</i>		
Number of study groups	285	
Membership of study groups	3 306	
Number of meetings or gatherings	1 027	
Number of Programme Planning Committees	118	
Membership of Programme Planning Committees	898	

The above are some of the chief activities of the professional officers and technicians in extension offices

in the Republic and South-West Africa. The distribution of these offices is shown on the accompanying map. For purposes of organisation the Extension Service is divided into eight regions, seven in the Republic and one in South West Africa.

NEW TRENDS

The challenges of modern agriculture are numerous and require adjustments in not only the farming structure but also in extension methods. New trends can therefore be seen in the extension situation every year, and these differ from Region to Region.

Winter Rainfall Region

Two *extension liaison committees* one in Worcester and one in Ceres, were established during the year under review. Agricultural extension workers from the private sector, co-operatives and control boards, together with agricultural extension officers and researchers of the Department, are members of these committees, which concern themselves with the identification of agricultural problems and the formulation of solutions, ensuring responsible and uniform communication of information to the farmer. Because the researchers concerned take cognisance of practical problems at these quarterly meetings, it is possible to conduct research accordingly and so make it meaningful.

Group discussions as a technique are being used to an increasing extent in this Region, so much so that farmers' associations have started holding panel discussions on their own initiative. This application of a known technique has contributed greatly to the publicising and understanding of programme targets among farmers and private organisations.

Practical studies conducted in the past and their advantages are now being applied increasingly on the farms of collaborators in the Upper Berg River Project and by other study groups. These records and a soil classification are being used to great advantage in determinations of potential.

Hour gatherings and mini farmers' days are becoming increasingly popular with farmers in the Winter Rainfall Region. The fact that these types of gathering take one and two hours, respectively, of the farmer's time, means that *more* farmers can be contacted than with the old farmers' day gathering, where the farmer had to be away from his farm for a whole day.

Wines of origin, which are becoming increasingly important as a result of recent legislation, have made farmers quality-conscious. In order to exploit this quality consciousness, wine samples from certain classified soils

in the Stellenbosch extension ward are being evaluated in collaboration with the Oenological and Viticultural Research Institute so as to determine the influence of the climate and the soil on wine quality.

South West Africa Region

Fuel restrictions obliged officers in this Region to make special use of group gatherings to contact farmers.

The new owners of the *S.W.A. Boer*, journal of organised agriculture in South West Africa, co-operate very closely with all Departmental organisations, with the result that this journal is one of the extension officer's most important communication media.

Articles appearing in the quarterly news letter for extension officers are re-printed by the *S.W.A. Boer*, thus enjoying a much wider circulation.

Karoo Region

In the eastern parts of this Region, where there is more grass, it is clear that the introduction of livestock in the form of beef cattle is becoming increasingly acceptable. The rise in red meat prices and the increased demand are definitely stimulating this trend.

Accordingly, dryland wheat cultivation in the Burgersdorp and Colesberg extension wards is declining considerably so as to make place for perennial pasture crops.

It is only in the drier parts, such as the Laingsburg extension ward, that fodder crops are being planted increasingly, and oats is being sown instead of wheat to serve as stock feed during the dry summer months.

Free State Region

A very intensive study of yield norms and production techniques relating to the most important field crops and livestock enterprises is envisaged for 1974/75. The data from this study will be used to provide guidelines for adapted farming systems and farming enterprises in certain farming areas.

Highveld Region

A marked shift in emphasis from conservation to development is taking place in extension activities. The exploitation of agricultural land on the basis of inherent potential is a concept which is gaining ground with more and more farmers. Twelve three-day courses on soil use classification were held, and these were so successful that follow-up courses are to be held at the farmers' request.

On the same lines two highly successful short courses on dairy cattle farming were held at Senekal and Heilbron, in contrast with the past, when such courses were held only at the Agricultural College, with far poorer attendances.

Transvaal Region

Target areas, in which agricultural development is carried out systematically according to a network programme, were defined in each extension ward. Although the concept of agricultural development is not new, the method or procedure followed in this Region represents a new trend.

A *network programme* for the planning of water run-off control has also been finalised and published mainly among technicians. The use of network programming as a planning and work technique holds great possibilities.

A *diary report*, which underwent a three-month trial period, was developed by the Subdivision of Efficiency in collaboration with the Transvaal Region. This system of work measurement will be invaluable to management at all levels in staff allocation and in controlling staff utilisation. The introduction of this system can be seen as an important milestone in the development of extension work.

A *red meat production programme* was tackled on a very wide front by a project committee of the S.A.A.U. under the chairmanship of the Director of the Transvaal Region. This committee co-ordinates the contributions of all organisations with interests in red meat production in two target areas, namely the North-Western Transvaal sweetveld and the South-Eastern Transvaal. Co-operation by all sectors in one programme on technical and extension matters is definitely a new trend.

Contractors came forward for the mechanical erection of soil conservation works in three target areas in which water run-off control planning was done. The contributions of such contractors hold great promise for speeding up the erection of works.

Natal Region

The increase in the price of meat, particularly beef, had a tremendous effect on the whole farming structure of the Region. The main trends were as follows:

- (i) An intense interest in beef production.
- (ii) The integration of beef farming on artificial pastures in areas of intensive field crop cultivation — a trend which is becoming very noticeable, even on the sugar farms.

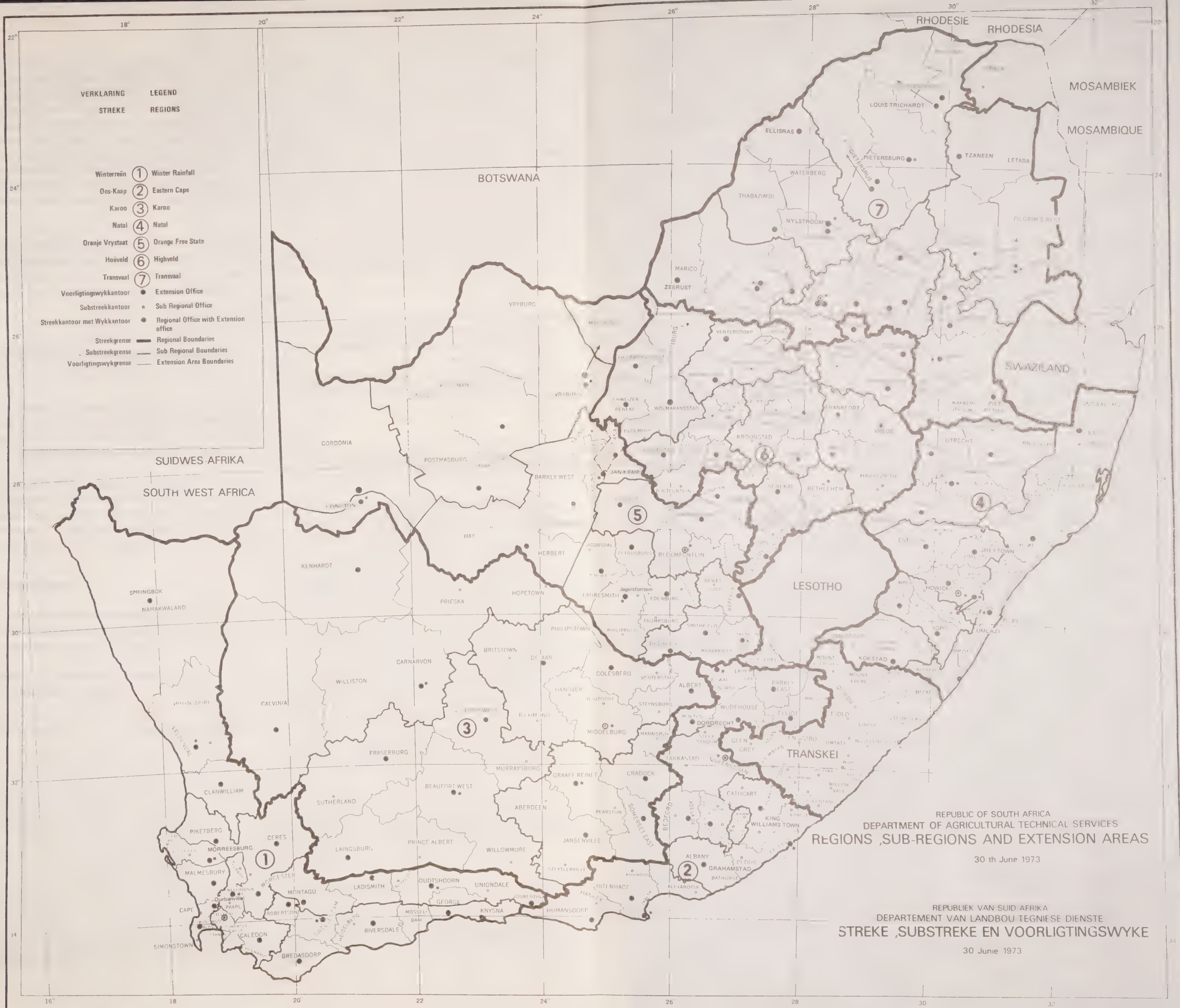
- (iii) A switch from dairy farming to beef farming, since beef can now be produced more economically on artificial pastures in high-rainfall areas.
- (iv) An increase in the planting of pastures for beef production in the high-rainfall areas.
- (v) A new interest in grazing management, aimed at high longterm beef production.
- (vi) A switch from field crops to artificial pastures for beef production on soils susceptible to erosion. A very striking trend towards improved management and farming practices become evident, particularly in the higher-rainfall areas. During the year under review this phenomenon, coupled with the whole revolution in beef production, made new demands on extension officers with regard to extension at a high technical level. The application of adapted beef cattle systems is becoming an important extension task in certain cases.
- (vii) Because field husbandry, particularly maize cultivation, is becoming increasingly important in Northern Natal, many officers are devoting much more time to the planning and protection of lands and advice on field husbandry.
- (viii) In the Natal Region's sugar belt mechanisation is becoming increasingly important. At present a few companies have large mechanical sugar-cane harvesting machines in the field, and this will inevitably lead to a change in the design and layout of sugar-cane fields. The mechanical harvesting of sugar-cane is completely contrary to the currently accepted principles of soil conservation as regards the layout of fields, and in future great caution will have to be exercised in this respect.

Eastern Cape Region

A *target area* was identified on the basis of pedological data released by the Soil and Irrigation Research Institute. This area is situated in the Bathurst-Alexandria area, and surveys are being undertaken to determine the farming situation and production norms. This information will be used in extension programmes at the farm planning level, and can be seen as a new development in the field of extension.

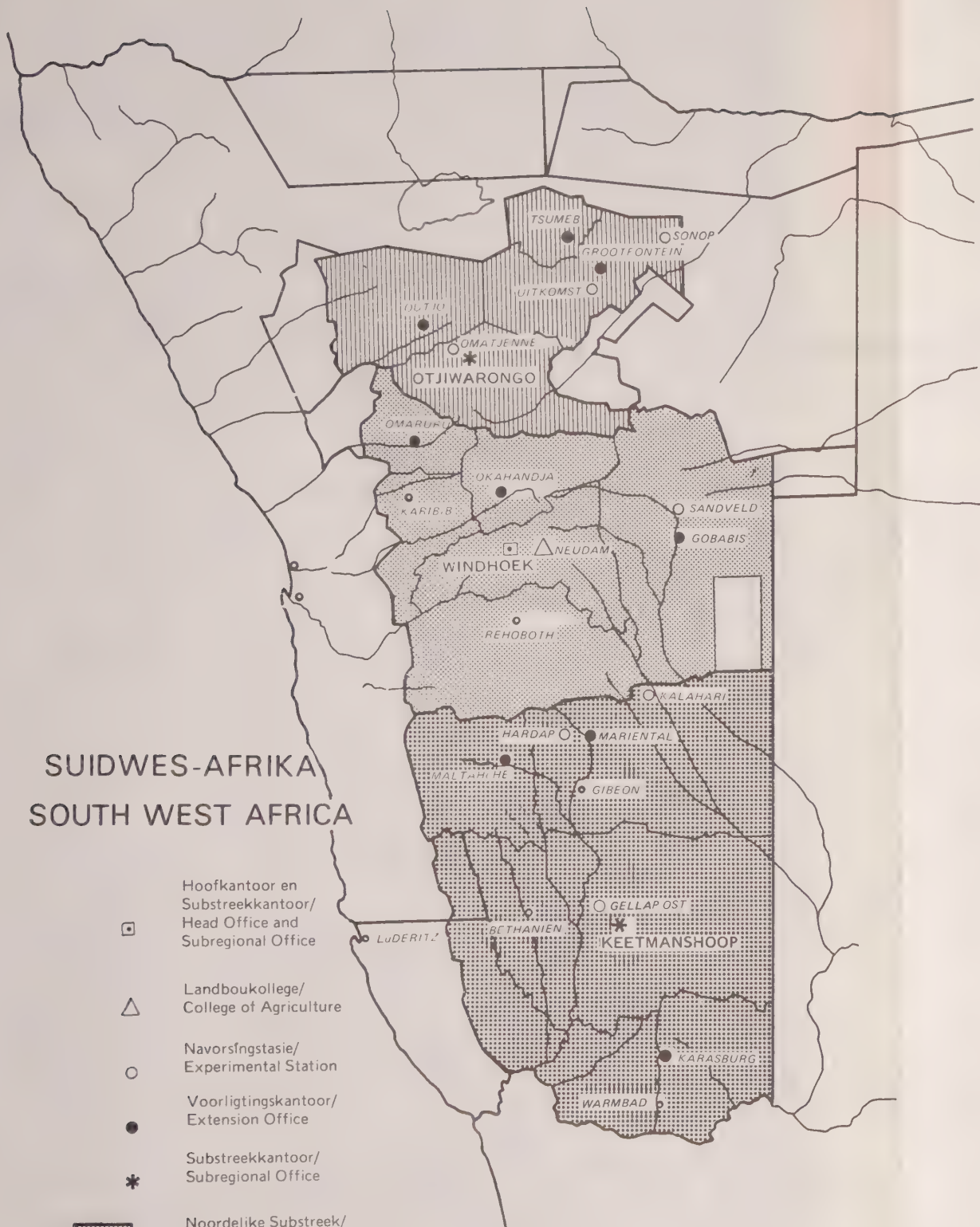
The *co-responsibility* of programme planning committees and the involvement of more farming leaders is giving extension in the Eastern Cape Region a new dimension, from which it can only benefit.

The *Stock Reduction Scheme* has led to closer contact at the personal level between participants and



SUIDWES-AFRIKA SOUTH WEST AFRICA

- 
 Hoofkantoor en Subtrekkantoor/
Head Office and Subregional Office
- 
 Landboukollege/
College of Agriculture
- 
 Navorsingsstasie/
Experimental Station
- 
 Voorligtingskantoor/
Extension Office
- 
 Subtrekkantoor/
Subregional Office
- 
 Noordelike Subtrek/
Northern Subregion
- 
 Sentrale Subtrek/
Central Subregion
- 
 Suidelike Subtrek/
Southern Subregion



extension officers, and has broadened the field of activities of the extension officer within his ward. Because this Scheme relates to veld and vegetal cover as well as the application of sound biological measures, a more favourable climate has been created for the soil conservation ideal. More and more younger farmers are taking the lead as champions of soil conservation, as is reflected by the latest nominations for soil conservation committees. Several of these young nominees have good qualifications and some have even had university training.

During farmers' days more time is being devoted to panel discussions, and formal lectures are being shortened. This provides an opportunity for wider participation and is conducive to the learning process.

PROGRESS IN PROGRAMME PLANNING

The principle of programme planning as a working method in the field of extension is already applied in all extension wards. At present there are about 150 planning committees involving nearly 1 500 farmers.

In a report of this nature it is impossible to report even briefly on the successes achieved with individual programmes. At the most, a picture can be given of the size and scope of this task in each ward. Only a few examples will be dealt with in greater detail.

Winter Rainfall Region

A total of 49 extension programmes, 17 of which relate to production efficiency and 32 to conservation matters, are under way in this Region.

These 17 production programmes cover the following enterprises or aspects:

Enterprise or aspect	Number of programmes
Vines	5
Wheat	4
Fruit	2
Irrigation	1
Turkish tobacco	1
Citrus	1
Dairying	1
Beef	1
Ostriches	1
Total	17

The 32 programmes aimed at conservation comprise the following:

Aspect	Number of programmes
Grazing management	8
Wind erosion	4
Contours	10
Waterways	3
Brack control	2
Catchments	3
Water conservation	1
Erosion structures	1
Total	32

Programme for the improvement of citrus cultivation practices in the Clanwilliam extension ward

Aims

- (i) To encourage producers to keep orchard records so as to establish which practices are being used.
- (ii) To compile a programme of desirable practices and to familiarise producers with the programme.

Execution

- (i) A records system was devised in collaboration with the programme committee (farmers).
- (ii) Each of the seven committee members visited five producers, intensively studying their operations and help them to keep records.
- (iii) The extension staff compiled a programme of desirable practices and familiarised 197 producers with the programme.
- (iv) Using this guide, the Goede Hoop Citrus Co-operative printed a farm almanac for 1974. This almanac, which gives the most important critical practices which should be applied during the various months, proved very popular among farmers.
- (v) A series of newsletters was used to deal with practices at greater length and to bring them to the producers' attention in good time.

The success of this programme was evaluated during July 1974 and will be made known in the next annual Report.

South West Africa Region

Without exception, soil conservation committees function as programme planning committees in this Region.



Members of the Winterhoek Study Group busy making an evaluation of the veld. A plant survey will subsequently be made and the two evaluations compared



Pasture scientists of the Department enlighten farmers about rotation methods on the farm of Master Conservation Farmer Koos van der Merwe in the Maltahöhe district of South West Africa



Judging of carcasses during a short course at Elsenburg



A group of young farmers who attended a short course in welding and the maintenance of tractors at the Grootfontein Agricultural College

In the Northern Subregion committees set themselves the task of raising the percentage of farmers following a judicious veld management system from 10% to 30%. Preliminary evaluations indicate that this goal has been met.

Soil conservation committees, in their capacity as programme committees, co-operate very closely with farmers' associations, thus involving the farmer at all levels.

New programmes which are being planned will aim at higher calving and lambing percentages and the establishment of *Cenchrus ciliaris* grass.

Karoo Region

Because stock farming plays a dominant role in the Karoo Region it is natural that extension programmes will be directed mainly at grazing control and drought feeding. The Stock Reduction Scheme and catchment planning are two other facets of agricultural development which also provide themes for the programmes which are under way at present.

The following extension programmes are at present under way:

Name of programme	Number of extension ward involved
Evaluation of veld improvement under the Stock Reduction Scheme	16

Progress — The excessive rains before and during the plant survey period seriously delayed this operation. For example, only 678 and 570 plant and photo surveys, respectively, could be made, as against 969 and 958 the previous year.

As relevant data become available they are used in extension programmes, thus gaining wider application.

Evaluation of the influence of the Stock Reduction Scheme on animal production

Progress — Highly illuminating results have been obtained from 247 participants in this programme indicating the Scheme's effect stock farming productivity. In four extension wards extension officers visited the participants at least twice to help them complete the registers. This gave very good results as regards reliability and completeness.

Owing to the great amount of figure-work involved plans are now being made to process these data by computer.

Promotion of the planting of drought-resistant crops

Progress — In the Jansenville extension ward 16 participants were persuaded to plant spineless cactus (*Opuntia* spp.) and particularly old-man saltbush (*Atriplex nummularia*). There is already a big demand for seed of the latter, which to some extent indicates the success of this campaign.

In the De Aar extension ward 13 participants planted nearly 65 ha of soutbos and 109 ha of spineless cactus. An average of 2 180 saltbush plants and 1 814 cactus plants are planted per hectare.

H.F. Verwoerd Dam subcatchment planning

There are 11 subcatchments in the H.F. Verwoerd Dam's catchment area which is situated in the Karoo Region.

Progress — The soil survey phase has been completed in five of the subcatchments and the planning phase in three of the subcatchments.

The execution phase is not going satisfactorily, however, because only a small percentage of the recommended works have been completed. In future emphasis will therefore be placed on this aspect of the programme.

Situation determination of farming practices

Progress — Comprehensive situation determinations were carried out very successfully by the soil conservation committees in three of the four extension wards. These data relating to practices such as farm planning, grazing management, stocking rate, herd composition and crop cultivation are at present being processed for use in future extension programmes.

Propagation of sound grazing management measures

Progress — The soil conservation committee organised 17 successful group gatherings on individual farms. Plant surveys were carried out on these farms to classify plants into desirable, less desirable and undesirable groups. Veld reaction under different utilisation systems is demonstrated in this way.

The introduction of beef farming on the veld

Progress — In the Burgersdorp district 15 participants are keeping records to determine the economic implications of beef farming on the veld. Two participants are busy establishing, on a planned trial basis, what the desirable cattle/sheep ratio should be.

These data will be indispensable in the execution of future programmes.

Free State Region

During the year under review 12 extension programmes were carried out compared with 16 the previous year. It was decided to undertake fewer programmes of this kind because a large-scale study of yield norms and production techniques had been planned for each extension ward — a comprehensive task which is taking a great deal of time.

Despite excessive rains since February 1974, which had disastrous results in several extension wards, the following programmes were carried out successfully. Thirteen programme committees, with a membership of 115, were involved in these programmes.

Programmes

Title — Extension programme for the promotion of swarthaak control in the Molopo Soil Conservation District.

Aim — To persuade the participants in the programme to clear at least a further 10 per cent of their farm area of swarthaak.

Results — A survey involving 36 participants showed that the average area per participant cleared during the year under review was 519 ha or 13 per cent. This programme's short-term goal has therefore been achieved. Many farmers who were not involved in the programme have also joined in the fight against swarthaak, which shows that this programme is having a ripple effect.

Title — Extension programme for the promotion of swarthaak eradication in the Mafeking extension ward.

Aim — To get the participants in the programme to clear at least 10 per cent of the infested area of their land of swarthaak.

Results — The farmers who participated in the control programme cleared 5 920 ha this year, i.e. 13,7 per cent of the infested area. Of the 5 920 ha a total of 1 044 ha (17,6%) was cleared completely. All bushes were removed on 2 131 ha (36%), of the land cut the trees were left, while on the remainder of 2 745 ha (46,4%) only the swarthaak was removed. Of the 5 920 ha which were cleared, 1 168 ha (19,7%) are being ploughed, the remaining 4 753 ha (80,3%) is being used as grazing.

Title — Extension programme for the promotion of *Cenchrus ciliaris* (buffel grass) planting in the Mafeking extension ward.

Aim — To persuade as many farmers as possible to plant buffel grass on poorer lands.

Results — The area under buffalo grass more than doubled this year. During the year under review about 2 000 ha of buffel grass were established, as against 1 500 ha the previous year.

Title — Special attention to the Stock Reduction Scheme participants in the Postmasburg extension ward.

Aim — To get all the participants to comply with Scheme's conditions.

Results — Officers paid visits to 30 of the present 49 participants. The other participants were visited by soil conservation committee members. It was found that only 3,3 per cent of the participants now apply poor grazing management, as against 17,4 per cent the previous year. As regards the erection of facilities, only 13,3 per cent of the participants still have to erect a considerable number of works for the application of judicious veld management. The veld of 36,9 per cent of the participants who were visited is in good condition, that of 44,6 per cent in a reasonable condition and that of 18,5 per cent in a poor condition. All the participants' livestock numbers were within limits.

Title — Improving grape farmers' knowledge of pruning short-pruning grapes in the Upington South extension ward.

Aim — To expand farmers' and their labourers' knowledge of pruning short-pruning grape types.

Results — Pruning demonstrations, which were attended by 172 farmers and 142 labourers, were held at 17 places in the ward during the previous year. A survey of the farmers who attended the pruning demonstration showed that only 29 per cent still prune their vines incorrectly.

Title — The improvement of irrigation management practices on properties in the Vaalharts irrigation area.

Aim — The physical planning of at least 50 properties during the year under review.

Results — During the year under review 135 properties with a combined irrigation area of about 3 500 ha were planned. Farmers with planned properties find, for example, that they require less labour because irrigation water is easier to control and that water is saved through eliminating over-irrigation.

Title — Promotion of veld management practices in the Barkly West extension ward.

Aim — To activate the 63 veld record collaborators to persevere in keeping records.

Results — Because 21 of the collaborators were either professional men or were field crop-orientated, they stopped keeping records. The keeping of veld records was seriously hampered by the continuous rains during the year under review. Normal veld management systems could not be used because large parts of farms were under water and livestock had to be concentrated in limited areas. The remaining 42 members were prevailed upon to collect these essential records, however.

Title — The promotion of perennial fodder crop production in the Sannaspos soil conservation district.

Aim — To persuade 5 farmers to establish 20 ha of Columbus grass each, 2 farmers to establish 10 ha of dryland lucerne each, and 10 farmers to establish 3 ha of buffel grass each.

Results — Six farmers established 296 ha of Columbus grass, 3 farmers established 90 ha of dryland lucerne and 10 farmers planted 60 ha of buffel grass!

The Sannaspos Farmers' Association purchased a special buffel grass planter for use by members and other farmers.

All indications are that the farmers in the Sannaspos soil conservation district are becoming increasingly aware of the value of perennial summer fodder crops.

Title — The physical planning of farms in the Egmont subcatchment.

Aim — To carry out comprehensive physical planning of the 60 farms in the subcatchment during 1973/74.

Results — Good progress was made in the execution of the programme. A total of 52 farms were comprehensively planned, physically and hydrologically, according to soil capability classes. An after-care programme is envisaged for 1974/75 to promote the erection of proposed works.

Title — The physical planning of farms in the Slykspruit subcatchment.

Aim — To carry out comprehensive physical planning of the 131 farms in the subcatchment within three years.

Results — During the year under review 42 of the 131 farms were comprehensively planned, physically and hydrologically, according to soil capability classes. All indications therefore are that the programme's goal will be attained.

Title — The implementation of proposed farm planning in the Nuwejaarspruit subcatchment.

Aim — (a) To persuade 10 farmers to erect all the camp fences and stock-watering points proposed in their farm plans during 1973/74.

(b) To get the landowners concerned to fence off and withdraw the area affected by the 12 State works from grazing.

Results — Four farmers completed the erection of the camp fences and stock-watering points proposed in their farm plans, and 15 partially completed these. These 19 farmers erected 67 148 metres of camp fences and 7 stock-waterings. The area affected by 5 State works was fenced off by the farmers concerned, and the area affected by 8 State works was withdrawn from grazing.

Considering the negative attitude to subcatchment planning which was originally taken by the landowners, the progress made may be ascribed to the intensive after-care programme, which consisted chiefly of visits to individual farms.

Title — The after-care of participants in the Stock Reduction Scheme in the Fauresmith soil conservation district.

Aim — To persuade 20 farmers to apply a grazing system.

Results — Eight farmers were persuaded to put the camp system which was prescribed for them into practice. With a few exceptions all the participants in the Scheme rested at least a third of their veld during growing season.

The excessive rains from February 1974 and the exceptionally wet conditions which resulted placed serious restrictions on the execution of the programme.

Highveld Region

In this Region, where field crop enterprises play a dominant role, a great deal of time was devoted to the Regional Development Programme, and less time to extension programmes at the ward level.

Regional Development Programme

The Regional Development Programme gained wide acceptance during the year under review, and

programmed action by ward officers was directed chiefly at a working programme in the development areas concerned.

The following progress was made:

- (i) A total of 22 development areas representing 843 farming units with a total area of 402 742 ha were designated.
- (ii) Regional maps with photo backgrounds were compiled showing individual farm boundaries, more comprehensive run-off control planning and soil mapping units.
- (iii) Twelve three-day courses in land use classification were held in development areas from August to October 1973, and were attended by 411 farmers.
- (iv) Stereoscopic classification on the basis of soil-type boundaries in respect of all development areas mentioned in paragraph (i) was completed during November 1973.
- (v) Seven priority areas (one in each subregion) were nominated. These priority areas cover 177 225 ha, 63 per cent of which can be ploughed, and represent 372 farming units. All subregional staff are at present working in the various priority areas in their subregions. Stereoscopic classifications (mentioned in paragraph (iv)) were followed up during January and February 1974 with extensive soil management in the course of which soil-type boundaries were plotted on contact photos on the basis of binomial classification and phases thereof. Chief extension officers report that in this process 1 000 to 2 000 holes were drilled with hand-drills in each area in order to show the exact boundaries between the different mapping units on the contact photographs.

The following operations have therefore already been completed in priority areas:

	Area	Farming units
Stereo-interpretations	177 225 ha	372
Veld management	83 075 ha	191
Profile description		
and sampling	36 530 ha	102
Rounding off and codifying	15 630 ha	30

Extension programmes

The following extension programmes were launched on an extension ward basis:

Soil classification and economic studies	3
Grazing management	3
Training of soil conservation committees	3
Liming programme	1
Water run-off control	1
Red meat production	1

Owing to priorities in the Regional Development Programme little progress with ward programmes was reported. The following are a few highlights, however:

In an artificience pastures programme in the North-Western Free State the extension officer at Odendaalsrus —

- (i) presented 24 slide lectures on the theme "Establishment of Buffel Grass (*Cenchrus ciliaris*)" from June to September 1973, which were attended by 250 farmers;
- (ii) visited 72 farms to propagate the planting of buffel grass; and
- (iii) published several articles with the same theme in the extension news letter. A survey conducted during June 1974 showed that 64 farmers had planted 795 ha of buffel grass, 558 ha of which has been successfully established.

The soil conservation programme at Parys was concluded after an evaluation showed that the goals concerned had been reached. The initial situation showed that an area of about 6 000 ha belonging to 10 farmers had 3 000 ha of cultivated land, 80 per cent of which urgently required mechanical protection. An evaluation survey showed that 4 453 metres of watercourses and 61 km of contours had been provided. Ninety per cent of the farmers in the area had erected the necessary protective works, and conservation measures were being applied on all their cultivated lands.

Transvaal Region

With the finalisation of the network programme for agricultural development and its coming into operation the following progress in general programme planning was made in this Region.

Definition of target areas

The programmed approach to agricultural development was explained to all field staff at a regional conference. This approach necessitated certain target

areas within extension wards, being defined, in contrast with the more superficial programmes in the extension ward as a whole.

A points scale developed by the Highveld Region was used to serve as a uniform basis for the definition of target areas.

A total of 23 target areas with a combined area of about 1 200 000 ha were defined, involving nearly 1 200 farmers. The number of farmers in 22 target areas varies from 30 to 80, and in one case a "target audience" of about 120 farmers was chosen in collaboration with whom a programme was launched.

Collection and processing of natural and physical data

A specific section was organised at regional level to assume responsibility for the collection, processing and mapping of all existing natural and physical data on target areas.

During the year under review maps and tables relating to geology, soil, temperature, hail and frost occurrence were compiled for the 23 target areas and made available to the extension wards.

The first phase of the network programme was thus completed.

Accordingly, a start was also made with the other two aspects of phase 2, namely situation determinations and soil classification.

Preparation of maintenance schedules

During the year under review maintenance schedules relating to dairy farming, beef farming, tobacco (flue and air-cured), small grain, citrus, vegetables, subtropical fruit and maize were devised in collaboration with researchers at research institutes and with other researchers.

These maintenance schedules were standardised so that the data processing can be done by computer. This will make it possible to save a great deal of time in the future.

Situation determinations and soil classification

The following situation determinations were completed on the basis of the above-mentioned maintenance schedules in the target areas:

Target area	Number of farmers
Zoutpansdrif	50
Cullinan North	104
South-Eastern Transvaal (target audience)	106
Total	259

Soil classifications were undertaken in the following target areas:

Target areas	Area (ha)
Alma	40 000
Kendal	7 000
Kafferspruit	5 000
Total	52 000

General progress with programmes

Programmes in the Thabazimbi and Ellisras wards with the theme "Know your Veld" were exceptionally successful during the past year. The newsletters which are distributed monthly in these wards to back up the programme are exceptional publications which have earned high praise in all quarters.

In the Brits extension ward the programme for increased wheat production is being continued. Apart from this, a programme is under way in the ward to measure irrigation efficiency and has already yielded illuminating results.

Good progress has been made at Louis Trichardt with a programme aimed at efficient grazing management. Two very successful mini farmers' days were held, and according to an evaluation at least 20 farmers accepted the principle of correct grazing management.

The erosion control programme in the Piet Retief ward was concluded. This programme did not quite come up to expectations. At Wakkerstroom great success was achieved in promoting a healthy attitude to soil protection among the members of the Town Council. The Council now very strongly favours the development of the town common.

The programme to familiarise 10 farmers in the Zeerust extension ward with the principles of sound grazing management practices was continued. Good progress was made up to the end of March 1974, when the extension officer post fell vacant.

The programme in the Rustenburg extension ward aimed at resting the veld and the expansion of knowledge of grass indicator types was very successful and has been concluded.

Natal Region

Under the Natal Region's development programme eight extension programmes were approved in this Region in 1974, viz:

- (i) four programmes for the promotion of beef production in the Estcourt, Underberg and Kokstad extension wards;
- (ii) two programmes to promote maize production in the Dundee and Ladysmith wards;
- (iii) one programme relating to milk production efficiency in the Newcastle extension ward; and
- (iv) one soil conservation programme aimed at protecting the sloping fields of Indian farmers in the Pinetown extension ward.

Progress with existing extension programmes

The Melmoth and Eshowe soil conservation committees concentrated chiefly on inspecting and issuing directions for the working of new lands which are due to be planted to sugar-cane. Good progress was made with these two programmes.

Although good progress was made with efforts to get the sugar farmers of Eshowe to practise strip cultivation, there are still cases where large unprotected fields are ploughed up completely in one operation. This causes great topsoil losses if it rains afterwards.

The progress made by the Pinetown extension officer in a programme with Indian farmers in the Umkomaas Valley deserves mention. The main success scored was to persuade these farmers, whose fields have gradients of 30 to 35 per cent, to cultivate their pineapple fields on the bench terrace system.

Another problem requiring the constant attention of the Melmoth and Eshowe planning committees is that fields are ploughed up and down slopes.

A special propaganda campaign was also launched to combat the burrowing nematode *Radophulus similis* in banana plantations.

Exceptionally good results were obtained with Underberg extension officer's sophisticated feeding programme. Apart from the 170 soil samples and 130 feed samples from 20 participants which were analysed, emphasis was placed on conveying information on the results, and this effort can be considered 80 per cent successful.

Progress with the regional programme for the protection of fields did not come up to expectations this

year, however. Only 32 per cent of the area of the lands for which contours were envisaged and 48 per cent of the envisaged waterways could be measured up.

In the coming year a special effort will be made to motivate collaborators to erect the required works according to specification.

Eastern Cape Region

The Director of this Region points out that the aim of the Department of Agricultural Technical Services, seen in the light of the concept "Optimum Land Use" can best be achieved by the planned execution of multi-dimensional programmes.

The programmes which are at present under way in this Region show a healthy balance between conservation and development, which is in harmony with the Department's aim, namely agricultural development.

The following key programmes and supportive liaison programmes have been registered and are under way:

A key programme for veld improvement and utilisation, with 21 supportive liaison programmes relating to, *inter alia*, desirable large stock — small stock ratios, rotational resting of the veld, agricultural situation planning, resting of veld, the fencing off and treatment of eroded areas, the combating of undesirable tuft grasses, fencing off active driftsand areas and the propagation of the group-camp system.

A key programme for protecting cultivated land from erosion, with 13 supportive liaison programmes.

A key programme for community development, with 3 liaison programmes.

A key programme for catchment planning, with a pedological liaison programme in the Kat River catchment area.

A key programme for small stock management with a liaison programme for the promotion of sound management practices in the Adelaide extension ward.

A key programme for the promotion of red meat production, with one liaison programme in the Aliwal North extension ward.

The following two liaison programmes, out of a total of 43 such programmes, may be taken as examples of the range and content of the average liaison programme in this Region.

Name of liaison programme:

Veld resting programme for the Uitenhage brushland

Aim — To persuade 80 per cent of the farmers, within five years, (a) to rest a third of their grazing annually in rotation for at least one growing season (valley brushland 12 months from 1 March and open brushland 9 months from 1 September); and (b) to maintain a realistic carrying capacity, as determined under the Stock Reduction Scheme.

Extent — The area covered is about 278 000 ha and belongs to about 200 farmers. It includes parts of the Uitenhage and Kirkwood districts and may be described as the area north of the Great Winterhoek range, excluding the Sundays River Valley irrigation area.

Date of commencement — 25 March 1971.

Progress — The following table shows the extension inputs during the year:

Extension inputs in the veld resting programme for Uitenhage Brushland during 1973/74, classified according to extension methods, with the results measured against the aims

Extension method	What was aimed at	What was achieved
1. Mass methods		
Radio bulletins	12	5
Press reports	As necessary	None
Articles in agricultural journal	Invitation of representatives to inspect successes	3
Newsletters	3	3
		2 (636 printed; preceded by 2 editorial meetings)
2. Group methods		
Meetings	12	12 (61,3% attendance)
Visits to successful cases	6	7
Farmers' days	1	None
Film shows to all farmers' associations	8	1
Report/lecture to each farmers' association	8	1
Farmers' tour	1	None
Closing function	1 1	1
3. Individual methods		
Visits to farms	78 (6 per member)	86 (6,6 per member)
Letters	As necessary	18

The usual committee surveys were again made and evaluated. Condensed information from the data processed shows the following:

- (i) It is encouraging that 25,9 per cent of all drylands were used for perennial fodder crops, as against 1,4 per cent last year. At the same time annual fodder crops dropped from an average of 8,4 morgen to 1,8 morgen per farm.
- (ii) Despite the good product prices and the good veld, small stock dropped by an average of 174,5 units and large stock by an average of 6,1 units per farm.
- (iii) More veld was rested for 9 months or longer, namely 52,1 per cent, as against 35,5 per cent last year.
- (iv) More fodder was stored, namely 31,9 tons per farm as against 19,4 tons per farm last year. More fodder per 1 000 small stock units was also stored, namely 51,7 tons as against 23,4 tons the previous year.

Name of liaison programme — Establishment of dryland lucerne on cultivated land in the Molteno extension ward.

Aim — The aim is to persuade farmers in the Molteno extension ward to plant at least 40 per cent of their drylands to lucerne within five years from July 1972.

Progress — At 1 January 1972 only 8,3 per cent of the drylands were under lucerne. At 1 July 1973 lucerne had been established on 15,3 per cent.

In the annual evaluation of the programme it was found that 31,3 per cent of the drylands are already under lucerne. This figure indicates that the target of 40 per cent set for 1977 has already virtually been reached. The evaluation also shows that farmers intend to plant a further 59 per cent of their lands to lucerne in the future.

In the light of the foregoing particulars, the success achieved with this programme may be described as exceptional. The greatest incentive for this programme may ascribed to a very successful farmers' day which was held at just the right time.

STUDY GROUPS AND PLANNING COMMITTEES

Study groups are composed of 10 to 15 farmers who are actively interested in a certain enterprise or aspect of an enterprise. Study groups are used in agricultural extension, not only to create a study situation for the members concerned, but also to act as a

means of communication for imparting agricultural knowledge to a wider audience.

During the year under review there were 285 separate study groups at work with a membership of 3 306. A total of 1 027 meetings or other group gatherings were held by these groups.

Each study group devotes attention to a specific subject, such as grazing management practices, the keeping of farm records, stock farming management practices, and so forth.

The scope of study group activities in each of the eight agricultural regions is now sketched briefly, with a few examples.

Winter Rainfall Region

There are 46 study groups in this Region with a membership of 598. Membership per group varies from 6 to as many as 32.

The specific subjects dealt with include wine grapes, nurseries, table grapes, vegetables, irrigation scheduling, apple cultivation practice study, mail-in records, sheep and wool, dairy production, area planning, dried fruit cultivation, wheat production, citrus cultivation and drought-resistant crops.

In all extension wards soil conservation committees are intimately involved in programmes for the protection of natural resources.

The six soil conservation committees in the Swartland Subregion serve as programme planning committees for the 9 programmes which are being launched in the field of conservation, for example. Likewise all veld improvement programmes in the Region are backed by soil conservation committees which fulfil the function of programme planning committees.

There are 30 programme planning committees in the Region with a membership of 187.

South West Africa Region

Twenty study groups with a membership of 137 are active in this Region. Eight of these are mail-in record study groups which remain very active in the collection of business economics records.

Study groups at farmers' association level fulfil an essential function and act under the guidance of the soil conservation district committees. There are at present 12 such study groups in the northern and central subregions of this Region.

Problems under scrutiny by these study groups include the following:

- (i) Establishment of climax grasses in the veld by:
 - (a) planting cuttings in the veld; and
 - (b) planting grass seed by means of day pellets.
- (ii) The improvement of veld grazing through the correct use of Boer goats.
- (iii) The improvement of puddled veld through plough furrows and the intersowing of different types of grass.
- (iv) Grazing control and different camp systems.
- (v) Increasing calving and lambing percentages.
- (vi) Proper record-keeping.

Karoo Region

The 38 study groups with a membership of 328 in this Region held a combined total of 56 meetings. The most important subjects studied were grazing management (veld improvement and veld fire), drought-resistant crops and fertility problems in sheep.

There is a study group in the De Aar extension ward, namely the Petrusville Study Group, which is unique because of its composition and wide range of activities. The group consists of 17 members who are divided into eight working groups.

Their fields of operation cover the following subjects (the number of members in each working group is given in brackets):

Mail-in records	(17)
Costs and marketing	(2)
Artificial insemination	(2)
Dissemination of information	(3)
Drought-resistant crops	(17)
Performance testing of woolled sheep	(2)
Performance testing of mutton sheep	(2)
Establishing vegetation at weirs	(2)

A group of 10 members went on a tour of the Grootfontein College of Agriculture and the Jansenville District to study drought-resistant crops.

Lectures on veld analyses, stock licks, creep feeding of lambs, fattening of sheep and performance testing of Dorpers were given by officers of the Department at the study group's meetings.

In the Jansenville extension ward there is a very active study group, namely the Winterhoek veld improvement study group. This group devotes a great deal of attention to the identification of veld plants and the objective evaluation of the veld. In this way members learn to look closely at the veld and not just to look it over. Members vie with one another in identifying the different types of vegetation.

Free State Region

This Region has 52 study groups, with a membership of 461, which held 233 meetings during the year under review.

It is significant that apart from keeping financial records most of the 28 mail-in record study groups also devote attention to several other aspects such as crop fertilising, cultivation practices, irrigation practices, feeding of sheep, etc. These additional activities help members to keep interested in the rather routine matter of keeping records.

The activities of a few of the 52 study groups are summarised below:

The Postmasburg study group investigated the effect of the stocking rate on the net farm income per R100 of capital investment. The following table gives the findings of this investigation.

The effect of the stocking rate on capital investment

Stocking rate categories	Rate (ha/LSU)	N.F.I. per R100 of capital investment
One-third of farmers with highest rate	9,98	R7,18
Middle one-third of farmers with moderate rate	16,46	R10,13
One-third of farmers with lowest rate	20,29	R7,43

The study group members with the highest rate therefore did not fare better financially than those with a lower rate, whilst those with a moderate rate fared considerably better.

The fodder crop study groups in the Mafeking extension ward found that though it is difficult to establish buffel grass *Cenchrus ciliaris* on the Sunbury Series of the Clovelly soil type, this grass yielded just as well as on other soil series in the vicinity. This is a very encouraging discovery in view of the fact that a large part of this area belongs to the Sunbury series, which causes serious wind erosion problems. Large tracts of the area concerned are covered with "yellow-wood" or Transvaal silver tree (*Terminalia sericea*) and grazing is

poor there. If the Transvaal silver tree can be eradicated and grass established, a considerably higher red meat output would be possible.

The 17 members of the vine study group in the Bloemfontein West extension ward put 86,7 ha under vines with a view to a wine quota. The cultivars Hanepoot (40 per cent), Barlinka (25 per cent) and Sultana (10 per cent) were established. A further 25,7 ha were planted by three members with a view to table grape production.

Another aspect which is receiving attention is the method of irrigation. In this connection flood, sprinkler, drip and micro-irrigation are being compared. No conclusions can be drawn at this stage, however.

The grain sorghum study group in the Brandfort extension ward had problems with seed and germination. Fertiliser was applied in accordance with soil series classification and chemical analyses. A topdressing of 50 kg of limestone ammonium nitrate was applied to half the plantings. No increase could be obtained in this way.

The cultivars SSK2, SSK26 and NK283 gave the highest yields, viz 50 bags per hectare. SSK2 and NK283 have now shown themselves to be suitable cultivars for the Brandfort District.

In this Region it is felt that soil conservation committees should concentrate not only on soil conservation matters, but that they should function in a wider sense as agricultural development committees within their particular areas.

Consequently 13 soil conservation committees, involving 115 members, acted as programme planning committees in the execution of extension programmes.

Highveld Region

During the year under review 25 study groups with a combined membership of about 250 were active in this Region. Various subjects were dealt with, and can be summarised as follows:

	Study groups	Membership
(i) General production studies (including maize production, red meat production, milk production, wheat production, wool production and grazing management)	11	128
(ii) Economic farming analyses	8	82
(iii) Soil classification project	6	40

In this Region the role of these study groups is seen as a valuable extension medium for obtaining production norms and for testing extension recommendations in practice.

As record keeping by study group members progresses, farmers become more and more aware of the need to use the norms which are established, to serve as:

- (i) a management criterion through which farming mistakes can be tracked down and corrected; and
- (ii) a method by which farming budgets and plans can be drawn up.

Transvaal Region

There are 35 study groups in the Transvaal Region, studying the following subjects:

Subject	Number of study groups
Mail-in records	6
Subtropical fruit	2
Dairying	2
Meat production	3
Grazing utilisation	14
Field husbandry (fertilisation)	8

In future more attention will be given to mail-in record study groups once this Region has its own agricultural economist. Study groups will also gradually be activated in target areas to collect yield norms and study production techniques.

In all four the extension wards in the North-Western Transvaal the soil conservation committees function as planning committees. These committees are very active and enthusiastic and their dedication makes a very important contribution to the success attained with extension programmes in this Subregion.

Natal Region

From this Region it is reported that the valuable contributions made by study groups as extension media in Natal during the year under review cannot be over-emphasised. There are 33 active study groups with a membership of 632 in this Region. During the year under review 121 meetings and gatherings were held.

A wide range of subjects were studied during the past year, including the following:

Beef production, milk production, artificial pastures, maize production, sheep farming, pineapple production, forestry, mail-in records and economic planning. Most of these study groups are largely dependent on the Extension Service.

In the Coastal and the Southern Natal Subregion the soil conservation committees are being used very successfully as programme planning committees.

These committees are paying particular attention to the following:

- The protection of sugar-cane fields.
- The protection of natural bush (where titanium mining threatens the stabilisation of sandy soils)
- Beef production
- Banana production
- The protection of Indian farmers' pineapple fields
- Brack control in the Pongola irrigation settlement
- Resting of veld
- Feed budgeting.

Eastern Cape Region

The number of study groups in the Eastern Cape Region decreased by five during the past year. There are at present 21 study groups in the Region, three of which may be considered inactive. Membership of the active study groups rose by nine to 220 during the past year.

Membership of the mail-in record study groups increased during the year under review, largely due to the enthusiasm of the Regional Economist.

Activities and results of the Alexandria and Fish River study groups

The Regional Economist regularly attends meetings of the study groups and gives valuable guidance.

- (i) During the past year the Regional Economist presented a course for study group members in Grahamstown, which was followed by a labour seminar at which two of the three agricultural unions in the Region were also represented. The main aim of this seminar was to promote labour efficiency on farms.
- (ii) Seventeen (81 per cent) of the study groups in the Eastern Cape Region, with a membership of 206, are involved in the mail-in record system. Most of these study groups already have three or more years of economic analyses at their disposal and the stage had already been reached where definite conclusions can be drawn from the results. The most common deficiencies which were detected throughout the Region are high labour and

mechanisation costs and unsatisfactory calving and lambing percentages.

- iii) By diagnosing these deficiencies in members' farming operations and by correcting them, considerable progress has already been made towards economically efficient farming. Thus, for example, the net farm income per R100 of capital investment rose from R5,11 in 1972/73 to R8,28 in 1973/74 in the case of the Alexandria study group, whilst that of the Fish River study group rose from R6,41 to R10,22.

Humansdorp wheat study group

This study group's membership increased from eight to 12.

Aims — (i) To study and improve aspects relating to the economic production of small grains and their by-products.

(ii) To maintain close contact with the Department of Agricultural Technical Services, farmers' associations, the Humansdorp Co-operative, and companies, and to obtain and disseminate information.

Subjects being studied include cultivars, moisture retention, sowing times, sowing density, the potential of gravel soils with special reference to economy, fertilisation, weed control, crop rotation and the tillage of soils. This group is exceptionally active and has already progressed so far that recommendations on wheat cultivars, fertilisation and cultivation practices can be made to its fellow farmers.

The number of programme planning committees in the Eastern Cape Region dropped by 9 during the year because their task was taken over by soil conservation committees. There are at present 24 programme planning committees, with a membership of 183, which are working on 38 registered and 5 unregistered projects.

During the past year the Eastern Cape Region continued registering extension projects, and 21 new projects were registered. This brings the total number of registered extension projects in this Region to 39. One of these has already been completed and the final report submitted.

In every extension ward in the Eastern Cape Region there is at present at least one extension programme under way, and as many as nine programmes are being conducted concurrently in one ward.

In many cases the programme covers the whole ward so that each committee executes the same programme in its own area.

Programme planning has been accepted as a working method by the Region's extension staff, as well as by most of the soil conservation committees.

CONSERVATION FARMING COMPETITIONS

During the year under review 66 competitions were held in the 8 agricultural regions.

According to the Director of the *South West Africa Region* conservation competitions offer great advantages as regards extension and these competitions should be expanded. Regular farmers' days are held on the Winners' farms and farmers' associations take an active part in their organisation and donate trophies. Since these competitions were started in 1968, 17 master conservation farmers have been designated in South West Africa.

In the *Free State Region* very successful follow-up days are held on winners' farms and it is clear that the standard of participation has risen and that regular participants' farming has improved. The technique of publicising the results of winning entries in the community by means of colour slides rather than farmers' days appears to be very successful.

In a maize farming competition in the *Transvaal Region* the winner attained a yield of 8 826 kg per ha, as against 6 620 kg per ha by last year's winner.

In the *Natal Region* 29 competitions of a diverse nature were organised and 164 farmers took part. The 300 delegates to the International Sugar Technology Conference in Durban visited, among other places, the show sugar farm belonging to the winner of the soil conservation trophy in the Eshowe extension ward.

Officers in the Extension Service are convinced that farming competitions, particularly the traditional soil conservation competitions, are a very powerful means of propagating the idea of conservation.

EXTENSION RESEARCH AND SURVEYS

The range of extension research aimed at more practical situation determinations widened.

Only a few examples are given:

Winter Rainfall Region

Agricultural water requirements of the Upper Berg River and Eerste River Valleys — With a view to the allocation of water from the Theewaterskloof Dam which will be available for agricultural purposes, a survey was made of the present water situation in this area. This

information is supplementary to data which were already available from a comprehensive resource census survey in the Upper Berg River Valley.

In addition, the present land and water use patterns in the Stellenbosch District were determined, as well as those in the Klapmuts, Simondium, Great Drakenstein and Suid-Agter-Paarl areas. With these background data available it was possible to define priority areas on the basis of various criteria such as soil potential, the present level of agricultural development and the value product per unit of water applied.

It was also possible to compile a water balance for each of the different areas.

*Resource census and practical studies
in the Upper Berg River area,
Stellenbosch, Hex River Valley and Ceres*

A resource census report describing the resources of the Upper Berg River area was compiled and is being prepared for publication. The soil classification and the detailed mapping of 250 farms are more than 80 per cent complete.

The studies of practices relating to four of the main crops are going well and records of practices for two years are now available on 244 (80 per cent) of the wine blocks, 62 (74 per cent) of the table grape blocks, 44 (58 per cent) of the deciduous fruit blocks and 73 (71 per cent) of the cereal blocks on which the studies were started. The preparation of the first year's records for computer processing has been completed and a computer programme, which can accommodate all similar studies, was compiled to expedite the processing of the data.

A similar study of practices associated with wine grapes is under way at Stellenbosch and two years' records of practices have been kept on 115 vineyard blocks. The first year's records (1972/73) have been edited.

A study of apple cultivation practices at Ceres, which has also been under way for two years, is not making satisfactory headway because of difficulties in getting collaborators to send in the records. A study of table grape cultivation practices involving 67 collaborators in the Hex River Valley is going smoothly and the records are now being collected.

A liaison project, which is a sequel to the above-mentioned study, was undertaken in conjunction with the Fruit and Fruit Technology Research Institute in order to establish the effect of these practices, which is now known for the first time, on quality and keeping quality.

In the Karoo Region four soil conservation committees undertook comprehensive situation determinations under the direction of the extension officers in their wards. Such aspects as farm planning, grazing management, herd composition, and so forth were analysed in greater detail for use as a basis in extension programmes.

In the Free State Region an evaluation study of an extension programme was undertaken, type of research in the extension sphere.

A survey involving 71 farmers was conducted to gauge the progress made in the execution of the programme for farm planning and veld management in the Molopo soil conservation district (Vryburg extension ward). As regards the number of camps per farming unit, the survey showed that where as many as 46,8 per cent of the farmers had less than 12 camps per farm unit in 1971, this figure has now dropped to 28,2 per cent. The percentage of farms with 26 and more camps rose from 8,8 in 1971 to 26,6 in 1974. The average number of camps per farming unit rose from 13 to 19.

As was expected, the camp sizes have also tended to become smaller. The percentage of camps smaller than 120 ha rose from 24,9 in 1971 to 34,2 in 1974.

The average camp size per farming unit dropped from 248 ha to 185 ha. From the survey it appeared that the farmers are accepting the recommendation that camps should be smaller. Thus, for example, 84 per cent of the farmers identified themselves with the idea of smaller camps during the 1974 survey, as against 68 per cent in June 1973.

As regards the overgrazing of the pasturage, the percentage of offending farms dropped from 70 per cent in 1971 to 58 per cent in 1974. It is clear that much attention will still have to be given to this aspect of veld management.

The survey also showed that the percentage of farmers applying a reasonable to good veld management system rose from 16 per cent in 1971 to 44 per cent in 1974.

Good progress is therefore being made in the Molopo soil conservation district with the execution of proposed farm planning and efficient veld management.

During the year under review the Highveld Region reaped the benefits of intensive extension surveys on a land utilisation project conducted during previous years.

Each participant in this project was provided with detailed results which were dealt with thoroughly by the Regional Economist. In view of the high cost of mechanisation an engineer dealt with the advantages of

age implements. Groundnut yield studies were also analysed and presented.

Collaborators in the Eastern Free State realised a gross profit of R108,22 per hectare on high-potential soil during the favourable 1972/73 wheat season, whilst a gross profit of R71,37 per hectare was realised on low-potential soils. The profitability of wheat in this area compares favourably with maize, which realised a gross profit of only R39,60 per hectare on high-potential soil.

The results were different in the North-Western Free State: During the dry 1972/73 season maize realised a gross profit of R11,73, whilst groundnuts realised a gross profit of R70,12 per hectare. In the Eastern Highveld grain sorghum was the most profitable crop during the season concerned with a gross profit of R130,88 per hectare as against R105,96 for maize and R69,51 for sunflower seed.

Groundnut yield studies – During the year under review the Highveld Region succeeded in developing an arithmetical formula which enables land use planners to calculate the long-term average yield of groundnuts on the basis of rainfall, soil depth, moisture retention, the transpiration ratio and the grain/foilage ratio (50:50).

To test the accuracy of the method 50 yield studies were undertaken in those subregions of the Highveld Region where groundnuts are cultivated. In general it was found that farmer's yields fall within 80 per cent of the calculated yield, provided the effective soil depth is not restrictive in relation to the rainfall. This ratio is basically the same for summer cereals.

What is of interest in the case of groundnuts is that if the effective soil depth is sufficient or restrictive only 40 per cent of the calculated yield is attained in practice.

The Highveld Region now has formulae to calculate maize, maize silage, wheat, grain sorghum, sunflower and groundnut yields. Work is now being done on a yield formula for dry beans.

Mechanisation surveys – The short mechanisation survey which was conducted at Delmas during 1972/73 in conjunction with the Division of Agricultural Engineering resulted in a two-day seminar at Delmas on agricultural mechanisation planning in January 1974. This was attended by 60 farmers as well as by officers and representatives of tractor and implement manufacturers.

This survey and seminar by the Division of Agricultural Engineering were the first of their kind in the country. The seminar was so successful that similar seminars will be held in other parts of the Highveld Region.

Transvaal Region

In the Transvaal Region exceptional progress was made in the field of extension research and surveys:

- (i) Standardised survey schedules were devised so that data processing, which is time-consuming, can be done on the computer by means of standardised programmes.
- (ii) Standardised computer programmes were compiled in consultation with the Department's Division of Data Processing.

During the year under review the following comprehensive situation determinations were undertaken in predetermined target areas.

- An investigation of the efficiency of fresh-milk farming on farms of all registered producers in the South-Eastern Transvaal.
- An investigation of the efficiency of beef farming in the Cullinan North soil conservation district.
- An investigation of the efficiency of flue-cured tobacco farming in the Brits District.
- A comprehensive investigation of the agricultural potential of the Springbok Flats and the formulation of suitable farming systems were completed. These data will be incorporated in extension programmes.

In the Natal Region all manpower was used in surveys and in the compilation of 30 beef farming systems which were designed in accordance with past surveys.

Some of these beef systems have been incorporated in the new "Guide to Beef Production in Natal" which has already been published and is available to farmers.

In the Eastern Cape Region particular attention is given each year to evaluation surveys involving a sample of 10 per cent of the farmers participating in the 21 liaison projects.

These surveys appear to be invaluable for gauging the progress of extension efforts, determining trends and modifying the targets already set so as to adapt to changed situations. A survey has already been planned to investigate the role of the part-time farmer in agriculture in the Eastern Cape Region.

A further survey involving 150 farmers has been completed to determine optimum resource utilisation in the high-potential coastal areas.

IN-SERVICE TRAINING

Owing to technological changes and new knowledge and techniques made available through research, professional officers and technicians in the field of extension continually have to be trained further. Much attention is therefore given to the in-service training of staff.

The following in-service training courses were offered in the *Winter Rainfall Region*.

Course	Number of field officers who attended
1. Grazing management	15
2. Irrigation	75
3. Soil science	29
4. Farm management	33
5. Stock-watering systems	12

In addition, all office assistants attended a week-long course in office administration.

In the *South West Africa Region* two extension officers received the B.Agric. (Hons.) (Inst. Agrar.) degree and two technicians received the National Diploma for Technicians. These qualifications were obtained during service and may therefore be regarded as training.

In the *Karoo Region* 10 extension officers and 5 technicians took short courses on land use planning, crop cultivation under irrigation, farm planning, veld management, and goats, and one extension officer attended a short course on Karakul farming.

The following courses were offered in the *Free State Region* (the number of field officers who attended each course is given in brackets): vine cultivation (32), farm management (37), Dorper judging (9), veld and herd management (15).

In the *Highveld Region* a short course on ruminants was given to 28 professional officers (including 8 from the *Transvaal Region*) and three land use planning courses, which were attended by 10 extension officers from other regions, were held.

The knowledge of those who attended was tested thoroughly before and after the courses to determine their increase of knowledge and thus the success of the course.

In this way the *Highveld Region* trained a total of 80 officers, including 14 from other regions, in land use planning. Every active chief extension officer, extension officer and technician in the *Highveld Region* can now use the stereoscope, carry out soil and veld

classifications, and convert the data collected into a land use plan.

The knowledge gained during the five-week courses is at present being used in the seven priority development areas in the *Highveld Region*, where a combined area of just over 100 000 ha is being classified.

The *Transvaal Region* sent 9 extension officers and technicians to the *Highveld Region* to be trained in land use planning.

This initial group has already started a training programme for colleagues in the *Transvaal Region*. This new proficiency in land use planning is already being applied in 7 of the 23 target areas by means of soil classification surveys.

In the *Natal Region* courses were offered on soil classification, beef production systems, mail-in records, farm planning and linear programming.

One extension officer in the *Eastern Cape Region* was taking the B. Agric. (Inst. Agrar.) course, while another was working part-time at his M. Agric. (Inst. Agrar.) dissertation.

In addition, 10 technicians were trained in soil science and hydrographic planning during a five-week course.

AGRICULTURAL EDUCATION

Student numbers at the four Faculties of Agriculture, and the degrees conferred, were as follows:

Student numbers at Faculties of Agriculture, 1974 (The numbers in brackets are for the previous year)

Faculty	Undergraduate (1st to 4th year)	Post-graduate
Natal	207 ¹ (212)	63 (63)
Stellenbosch	307 ² (209)	115 (90)
U.O.F.S.	224 ³ (146)	63 (62)
Pretoria	294 ⁴ (256)	129 (143)
Total	1 032 (823)	370 (358)

- 1 — Including 17 B.Sc. (Agricultural Engineering) students
- 2 — Including B. Agricultural Management and B.Sc. (Agricultural Engineering) students
- 3 — Including 112 B. Agric. students
- 4 — Including 43 B.Sc. (Agricultural Engineering) students and 1 B. Agric. Ed. student.

Degrees in Agriculture conferred, 1973/74 (The numbers in brackets are for the previous year)

Faculty	B.Agric.	B.Sc.	B.Sc. Agric. (Eng.)	B.Sc.Hons.	M.Sc.	D.Sc.D.
Natal	—	35 (40)	2 (—)	—	5 (10)	4 (6)
Stellenbosch	22 (27)	39 (33)	1 (—)	10 (25)	25 (12)	6 (4)
U.O.F.S.	4 (11)	14 (20)		12 (13)	9 (5)	2 (3)
Pretoria	—	32 (41)	9 (—)	18 (12)	9 (15)	4 (6)
Total	26 (38)		12 (—)	40 (50)	48 (42)	16 (19)

In addition to the degrees listed above 12 B.Hons. (Agricultural Management) degrees were conferred by the University of Stellenbosch.

In Addition to the formal training given at Colleges of Agriculture, a wide variety of short courses are offered to farmers.

Undergraduate and post-graduate students in Veterinary Science, U.P. 1974 (Previous year's figures in brackets)

2 nd yr to 5½ yr.	202 (188)
M.Med. Vet.	49 (49)
D.V.P.H.	2 (2)
D.V.Sc.	11 (13)

Short courses offered at Colleges of Agriculture

Degrees conferred in Veterinary Science, 1973/74 (The numbers in brackets are for the previous year)

Faculty	B.V.Sc.	M.Med.Vet.	D.V.V.G.	D.V.Sc.
Pretoria	49 (40)	2 (2)	1 (1)	3 (2)

Formal training at Colleges of Agriculture is designed mainly to meet the training needs of prospective farmers and persons interested in serving the agricultural industry in the technical field.

College	Number of courses	Attendance
Cedara	15 ¹	384
Glen	16 ¹	386
Grootfontein	12	430
Neudam	25	521
Potchefstroom	31	765
Stellenbosch-Elsenburg	12	433
Total	111	2 919

1 - Including all courses held in the Region concerned

Student numbers at Colleges of Agriculture, 1973/74 (The numbers in brackets are for the previous year)

College	Student numbers
Cedara	135 (106)
Glen	87 (65)
Grootfontein	65 (46)
Neudam	42 (41)
Potchefstroom	108 (102)
Stellenbosch-Elsenburg	101 (104)
Totaal	608 (464)

A comparison of the attendance figure at short courses held during the year under review with last year's figure shows a rise of almost 19 per cent. This is an indication that farmers are becoming increasingly aware of the value of these short courses.

The following table gives an idea of the variety of courses offered either at one of the six Colleges or in the various Regions:

Region	College	Short courses — field or subject
Natal	Cedara	Engineering, artificial insemination, economics, animal husbandry, phyto-geny, entomology.
Free State	Glen	Advanced dairying, artificial insemination, S.A. Mutton Merino, beef farming, Africander cattle judging course, cream testing and grading, dairy farming, milk testing, sheep dogs, farm business management, veld and herd management
Karoo	Grootfontein	Dorper sheep, home economics, tractor maintenance, veld management, the training of sheep dogs, fleece testing, irrigation farming, agricultural engineering.

Region	College	Short courses — field or subject
South West Africa	Neudam	Karakul course for beginners, refresher Karakul course, advanced Karakul course, pastures, artificial insemination of cattle, Karakul lamb description
Highveld	Potchefstroom	Veterinary science, dairy farming, beef production, Dohne Merino, winter cereals, maize and grain sorghum, oilseeds, fumigation, dry beans, wool, poultry, welding
Winter Rainfall	Stellenbosch- Elsenburg	Grain grading, insect control in stored grain, Mutton Merinos, pig farming, slaughter lamb production, Dormer sheep.

PUBLICATIONS

Popular publications

The pamphlet series, introduced to serve producers more specifically in the various production fields, was expanded further during the year under review. A total of 118 pamphlets with a combined printing of 532 950 have already been published on several subjects such as horticultural and vegetable production, citrus and subtropical crops, grazing matters and engineering aspects. The series on apples is almost complete, and other series are far advanced.

Arrangements for the provision of plastic covers in which leaflet series can be kept and classified are also being made with the various marketing boards and other organisations. Certain covers, for instance for the tobacco industry, viticulture, potatoes, bananas and cherries have already been supplied, whilst others (e.g. those for small grain) have been ordered.

Apart from the pamphlets 97 500 copies of farmers' day lectures, radio talks, manuals and commentary or slide series have been printed and distributed, as well as 160 500 of the weekly newsletter *Agricultural News*, 37 800 other newsletters, 45 950 agricultural reports from foreign offices and 9 600 library lists.

The circulation of *Agricultural News* was again expanded on a selective basis. This newsletter was sent to a considerable number of agricultural leaders at the request of Organised Agriculture and big companies serving the agricultural industry make full use of it as a source of Departmental information for their representatives in the various provinces. The establishment of the Division of Agricultural Information was expanded with a view to recruiting more news staff for the expansion of the news service.

Twelve pamphlets totalling 360 000 copies were supplied to wool farmers as a supplement to the journal *The Golden Fleece*. A total of 11 892 copies of pamphlets and journals were sold.

Three popular pamphlets on vine cultivation in the summer rainfall area (English), bee-keeping (English) and

household insects (Afrikaans and English) were published, and several publications were handled for other departments and prepared for offset printing.

The Departmental Annual Report of the Department of Agricultural Economics and Marketing (1972/73) was prepared, as well as four issues of the quarterly journal *Agrekon*. One issue of the journal *Forestry in South Africa* (No. 14) was prepared on behalf of the Department of Forestry.

Scientific publications

Agroplantae, Agroanimalia, Agrochemophysica, Phytophylactica

During the year 130 articles (105 in English and 25 in Afrikaans) were received, which is 21 more than in the previous year. Together with a carry-over of 101 articles from the previous year, 211 articles were therefore dealt with. Of these 128 were approved, 2 cancelled, 3 withdrawn, 3 combined with other articles, 14 rejected and 61 still under consideration.

Of the 128 approved articles 91 were published, and 37 were carried over to the following year. The year under review therefore ended with a carry-over of 37 approved articles plus 61 still under consideration. Of these 98 articles one was received during 1971/72, 18 during 1972/73 and 82 during 1973/74. Of the approved articles 6 date from 1972/73 and 32 from 1973/74.

Onderstepoort Journal of Veterinary Research

During the year under review three copies of this journal appeared, and a fourth is almost ready. The three issues which have appeared, viz Volumes 40(2), 40(3) and 40(4), contained 16 contributions. There was a slight drop in the number of contributions received compared with the previous year. Twenty articles were received and seven were carried over from the previous year. Sixteen of the 27 which have already appeared, 9 are already with the printer and 2 are awaiting publication.

Other scientific publications

Other scientific publications brought out were the following: Flowering Plants of Africa, Volume 42, Parts

3 and 4; Entomology Memoirs, Nos. 33, 34, 35, 36, 37, 38, 39; and Technical Communications Nos. 111, 112, 113, 114, 115, 116 and 117.

AUDIO-VISUAL SERVICES

During the year 18 synchronised slide series were completed and there are still 14 series which have reached various stages of completion. A total of 56 series was issued during the year, and various series were lent out 28 times in all.

The audio-visual program *Our Green Heritage*, in whose compilation and presentation the Division played a major role, was particularly popular at schools and was considered a great success everywhere. An extended tour was undertaken and places in the Transvaal, the O.F.S. and Northern Natal were visited. During November/December all itineraries to isolated places were cancelled owing to the fuel restrictions. A total of 33 places were visited and 32 200 viewers saw the shows.

By means of lectures, demonstrations and judging, assistance was given to several departments and other organisations such as the Department of Health, the Public Service Commission, the Scientific Advisory Council, the CSIR, Potchefstroom College of Education, the Pretoria College for Advanced Technical Education and at the shows at Nelspruit, Bethal and Middelburg.

CALLING ALL FARMERS

The past year's programmes gave a picture of both the increasing demands on South African agriculture and the agricultural industry's efforts to meet these challenges along the lines indicated by the Department's research and extension services.

The high meat prices had a country-wide effect on stock farming and information was provided in different ways on programmes, one of the topics being the intensification of red meat production on the basis of veld utilisation.

On the other hand prevailing prices and economic trends in agriculture were featured with a view to keeping producers informed of marketing requirements both in this country and overseas.

As in the past, the long-term goal of programmes has been to promote the Government's policy regarding national agricultural development. Interviews with leading agriculturists and individual farmers have made an important contribution in the effort to put across the idea of optimum utilisation of agricultural resources to the farming community, also with regard to agriculture's contribution to environmental conservation.

One of the factors to which the high circulation of the Department's published information material is due in the publicity which these publications have enjoyed on *Calling All Farmers*.

LIBRARY SERVICE

The past year's activities were directed mainly at publicising and improving the Central Agricultural Library's services.

The following publicity work was done:

- Exhibits were held at 5 different farmers' days, one of which, that at Bien Donn  , was attended by nearly 1 000 visitors. Exhibits were also held at two agricultural shows.
- The second library week was held in the Library, the theme being "The Central Library in Vision". The exhibition was opened with a cheese and wine reception which was attended by senior officers and colleagues from other libraries.
- Radio talks are given regularly by the Senior Librarian, and judging by the response these are very popular.
- *Publications* — A monthly news bulletin is sent to officers of the Department, including extension officers and officers attached to regional offices and institutes outside Pretoria and other libraries.

Agrolibri, which has appeared every two months since February 1974, is sent chiefly to non-officers, i.e. farmer members and members of the public who are interested in farming.

A newsletter on the library's activities is sent quarterly to officers and all other members of the Library.

The following was done to improve the Library's services:

- *The introduction of a subject reference librarian system* — Under this system the Department's fields of activity were grouped into four coherent subject groups and each group was given a subject reference librarian. All enquiries according to subject from both officers and private members are handled by these subject reference librarians. Subject bibliographies on any agricultural matter are compiled on request by the subject reference librarians.

Literature searches are undertaken in conjunction with research workers.

Introduction of a farmer's library — Publications of a more general nature which might interest farmers and private members will be arranged separately, and this library will have its own staff.

The co-operation of provincial library services has been obtained. Certain requests will be referred to those services and popular works of a more general nature will be purchased by these services.

The administration of exchanges has been taken over by the Library. A questionnaire was sent to all exchange organisations so that a comprehensive and correct address list could be compiled. At the same time this list serves as a guide to the distribution of the Department's publications.

The Library has acquired its own photocopying machine, which speeds up the photocopying service to its users.

During the year under review 3 332 complete works were purchased, of which 2 007 were issued to branch libraries and 1 325 were accessioned by the Central Agricultural Library.

In February the staff of branch libraries outside Pretoria gathered at the Central Library for an in-service training course. The local senior staff's in-service training programme consisted of visits to and lectures at the libraries at UNISA, ISCOR and the CSIR, as well as the data bank of the Department of Planning and the Environment.

3. Natural Resources

MAPPING OF LAND TYPES

The mapping of the boundaries of land types in South Africa on the scale 1:250 000 is about half finished. Topography, soil pattern and macroclimate are all indicative of notable similarities within a certain land type. Moreover, each land type is defined in terms of natural resource units, which consist of the three components climate, slope and soil type.

An inventory of the natural resources and land use was started; it is to cover about 14 000 km² which will include the area from Petronella in the north to the southern boundary of the Vaal Dam, and from Delmas in the east to Carletonville in the west.

A number of detailed soil surveys were carried out over about 57 000 ha of land in order to investigate the possibility of irrigation. The areas investigated are situated in the vicinity of Hoedspruit, Pongola, Cradock to Golden Valley, Heidelberg (Cape), Winterton and Riebeeck West.

AGRICULTURAL METEOROLOGY

In addition to the preparation of data for the computer for their own use at the Weather Bureau and the Department of Water Affairs, climatic surveys in the various agricultural regions of the country were continued. Additions were made to the existing network of weather stations, especially in the Lowveld, Karoo and Natal Regions. The construction of supplementary stations in the Highveld and Free State Regions is being planned at present.

Data processing

Daily rainfall and temperature data, which the Weather Bureau has been preparing for the computer since last year, were not yet available and analysis from the point of view of agricultural potential was therefore delayed. However, a start was made with the development of the computer system by means of which meteorological data from all the Regions and Institutes will be handled by the big new computer. The system will come into operation shortly. In the mean time the coding of all available daily evaporation data in the Republic, prior to punching on computer cards, has been started.

Agroclimate

Several projects were launched under the National Agroclimatic Programme. The charting of the thermoclimate, heat units and photothermic units has been completed and only the finishing touches are still required.

An investigation into aridity indices under South African conditions has been started. It appears that the Thornthwaite index cannot be applied in South Africa without certain modifications, and a new formula is being developed at present.

With the aid of the Departmental computer, researchers have started analysing the frequency distribution of the incidence of frost from data in the Orange-Fish River area. Good progress was also made with the analysis of the distribution of the probable seasonal rainfall.

The various aspects of the climate already analysed represent the first important step in the development of an effective classification of climate for optimal land use.

Evapotranspiration

The water requirements of crops in the Upper Berg River area were determined with the aid of daily meteorological data and a daily moisture balance was determined. The results of this research will be available shortly.

Data to be used for irrigation purposes are at present being collected at two points along the Fish River, viz at Cradock and in the Golden Valley. Apparatus at Cradock was damaged by last summer's floods and data recording was temporarily interrupted.

In the course of a project in which the water consumption of pears on dwarf rootstocks at Bien Donné is being investigated it has become apparent that the evapotranspiration of a full grass cover is only slightly higher than that of young, established pear trees.

Plant/climate relationships

With the appointment of an agricultural meteorologist in the Natal Region a start was made with the construction of a mathematical model to simulate photosynthetic processes in maize cultivation. Heat unit analysis of various types of vegetables grown at Cedara during the past three years is also being studied.

Data from the long-term maize trial at Potchefstroom have been investigated in relation to climatic variations over this period. It was found that the rainfall during the 65 to 90 days after planting is critical in determining the size of the crop. The results of this research have already been prepared for publication.

An analysis of weather data for the 1972/73 and 1973/74 cotton production seasons on the Transvaal Lowveld has shown that the poorer quality produced during the second season coincides with a considerably lower maximum temperature and higher degree of cloudy weather, especially during flowering time.

Correlations between weather factors and the picking dates of Ohenimuri and Granny Smith apples were continued. During the past season a series of storage trials was carried out with the aid of previous results: apples were harvested at various times around the calculated optimum picking date. These apples, picked at various times, will be examined for keeping quality after six months of storage.

There are indications that good navel areas, statistically determined with the aid of a survey in the industry, have a common characteristic, namely low maximum temperatures during the winter months. It would appear that 22°C may be a dividing line between good and less satisfactory navel areas.

A satisfactory mathematical model was developed with the aid of which environmental data can be used to determine the picking ripeness of bananas. It was found that the rate of ripening is independent of the stage of development, but that the temperature is critical in this process.

Wind-break studies

Citrus fruit from the Lowveld, the Rustenburg area and Citrusdal was examined for wind blemishing. The results indicate a linear relationship between the percentage of blemishing and the wind-work units during the first three months the fruit is on the tree. Similarly, a relationship was established between the total wind-work units and wind blemishing. It appears that the Lowveld, which has a relatively high humidity, has a higher incidence of wind blemishing per wind unit.

Research work on the efficiency of the various types of artificial wind-break was continued at Zebediela, Patensie and Bien Donné. Trials at Bien Donné showed that a net of plastic with 13 mm mesh, 75 mm long and 6 m high, reduced the wind speed by 9 per cent at best. Other materials are at present being tested on the same site.

Changing the microclimate

A survey near the Theewaterkloof Dam, aimed at comparing the climate before and after the completion of the dam, was continued. Strong winds were experienced, especially from the northern sector, and the indications are that a driftsand problem will arise after the completion of the dam.

Climate and geeldikkop

Measurement of the climatic factors in the area where geeldikkop occurs was continued. Last summer geeldikkop occurred sporadically after the first rains, but with the protracted heavy rains the disease apparently disappeared. This may be an indication that a fungus that occurs on vegetation and has spores that wash off after protracted rain is involved.

IRRIGATION RESEARCH

Tensiometers have been very useful in surveys to determine drainage losses of irrigation water at a soil depth of more than 60 cm. It was found that losses could be prevented by more frequent irrigation (possibly as many as two or three irrigations a day) with short application periods (e.g. 20 minutes).

It appears that scheduling formulas (as when evaporation figures are used) can only be used after the water delivery rate of the drip irrigators, the number of drip irrigators and the desired irrigation frequency for the specific application have been fairly accurately determined.

The flood and sprinkler systems on the Vaalharts Scheme were investigated. The loss of irrigation water was as much as 50 to 60 per cent with flood systems and averaged at 25 per cent with sprinkler systems. Suggestions for the improvement of the irrigation and drainage situation for the whole area were submitted in the form of a committee report.

IRRIGATION PLANNING

Various matters relating to irrigation development are dealt with by the Irrigation Planning Subdivision of the Soil and Irrigation Research Institute. Irrigation planning naturally involves various disciplines, and during the year under review the Subdivision co-operated closely with Institutes, Regions and Divisions and with other Departments.

Comprehensive irrigation situation studies with a view to viability or potential were carried out in various areas, including the following:

Neus-Augrabies, Bossieveld (Worcester), Oedspruit, Riebeek West, Breede River Valley, Jooysburg, Hopetown, Luckhoff-Jacobsdal, Lower Sundays River Valley and Lower Fish River Valley.

Several of these studies included the inspection of land for irrigation development. This inspection includes an irrigation suitability classification based on an interpretation of the physical (soil and slope) and production-economic qualities, so that each class represents a category of land with the same degree of irrigability, or reflects the relative level of income potential.

On the same basis a re-evaluation of the irrigability of the soils on the Pongola Scheme was undertaken. The irrigation areas below the Floriskraal and Bellair Dams in the Ceres area and the Little Berg River Irrigation (Tulbagh) area were also visited, in order to carry out irrigation determinations.

The replanning of the Hardap Scheme was continued and the planning of 14 irrigation farms has now been completed. The planning of the farm boundaries of the Rust area (Vanderkloof Irrigation Scheme) with the aid of soil maps and given sizes has been started.

Other joint investigations of irrigation matters in general have been finalised by means of reports; they include the following:

The geo-hydrological study of the Vaalharts Scheme in an attempt to find a solution to waterlogging and brack problems there; a comprehensive study of brack problems in the Hex River Valley; proposals for interdepartmental co-ordination of activities relating to irrigation and drainage, and the viability of irrigation farms on State and Irrigation Board Schemes.

SOIL CONSERVATION

The Soil Conservation Act

The year under review was once again characterised by the strict application of the Soil Conservation Act. Through inspections, complaints and reports by soil conservation committees 1 100 cases of suspected soil abuse came to the attention of the Division of Soil Protection. In 1 089 of these cases the land users concerned were visited or letters were written to them.

Of the persons approached 686 (63,0 per cent) responded favourably and 87 (8,0 per cent) unfavourably. The latter are therefore liable to disciplinary action and personal directions may be served on them in due course. Negotiations are still in progress with 316 (29,0 per cent) of the total number.

Experience again showed this year that there are very few cases where immediate legal action is possible. There is generally a time-lag between the date when a person suspected of malpractice is warned in connection with some form of abuse of the soil or veld and the date when there is sufficient evidence that the person is obdurate and cannot be persuaded to co-operate. The policy of the Division of Soil Protection has always been to try, through negotiation, to persuade suspected offenders to adopt the right views and course of action.

During the year under review 91 personal directions under the Soil Conservation Act were served in cases where land was not being used as it ought to be. During the same period 13 accused appeared in court and 12 were found guilty.

The publicity given to these court cases has a beneficial effect on the community. The land user's attitude towards the provisions of the Soil Conservation Act is determined largely by this publicity and the views of his fellow land users.

Soil conservation committees

The terms of office of the first committees appointed under the new Soil Conservation Act end on 30 September 1974. During the year under review a start was therefore made with arrangements to appoint new committees, and the Extension Service was asked to make the necessary nominations in co-operation with Organised Agriculture.

Although it is alleged that many of the soil conservation committees' interest seems to be flagging, most of them are fulfilling the function for which they were established. Most committees have already assessed the situation in their respective areas in order to determine protection priorities and programmes.

Regional advisory committees

The regional advisory committees all met during the year under review. Various aspects of the state of the soil in the various regions were thrashed out and problems in connection with certain aspects of protection were discussed at length.

The soil protection advisory board

The Soil Protection Advisory Board met only once during the year under review. A tour to South West



Veld recovery in the Karoo: the record rainfall of 506 mm in the first quarter of 1974 resulted in an excellent stand of grass at the Grootfontein Agricultural College

Africa and two further meetings were planned, but owing to the fuel-saving campaign these were cancelled.

Game farming was discussed thoroughly at the meeting which did take place. These discussions led to a one-day symposium at which game farming was discussed thoroughly. After the symposium a Departmental committee was appointed to investigate all aspects of game farming and to make recommendations on the necessary research and co-operation with other organisations such as the nature conservation authorities and the Parks Board.

Farmers' works

The expenditure on subsidies and grants in respect of completed soil conservation works increased slightly in comparison with the previous year:

Year	Subsidies on completed soil conservation works	Grants for flood damage repaired	Grants for grass ley crops on cultivated land
	R	R	R
1969/70	2 852 828	—	6 688
1970/71	2 967 684	599	11 849
1971/72	4 042 794	2 219	13 000
1972/73	4 239 404	10 161	15 684
1973/74	4 533 282*	8 674	7 688

* This amount includes R1 965 943 for subsidies on completed soil conservation works in South-West Africa

The following table shows that the increase discernible is on subsidies on completed soil

conservation works in South-West Africa. In the Republic there was actually slight decrease:

Year	Grants on completed soil conservation works in the Republic R	Grants on completed soil conservation works in South West Africa R
1969/70	2 852 828	—
1970/71	2 967 684	—
1971/72	3 023 651	1 019 143
1972/73	2 707 267	1 532 137
1973/74	2 567 339	1 965 943

According to the various regions the slight drop in the number of completed soil conservation works cannot be ascribed to a falling-off in the demand for survey work, but to the steadily deteriorating staff position. In the Free State Region, for example, only 54 per cent of the technician posts are filled at present.

Further reasons for the drop in completed soil conservation works are:

- A high percentage of the farm units in the Republic have already been planned and comprehensive works such as long fences and extensive stock-watering systems have already been erected.
- The increase in the prices of fencing materials and plastic piping coupled with a shortage of capital, is hampering the erection of works.

As a result of the increased subsidy tariffs (fences from 1/10/73 and other soil conservation works from 1/4/74) it is expected that in future there will again be an increase in the number of soil conservation works completed annually.

Most completed works still fall in the category of indirect erosion control works such as internal camp fences and stock-watering points. Direct erosion control works are still not enjoying the attention they deserve, though the Winter Rainfall Region reports that the erection of contour wall systems was the most important type of work which received attention in that region and that 1 837 kilometres of contour banks and 31 waterways were constructed.

Major farmers' works continue to receive relatively little attention, but as run-off control planning progresses works of this type will receive the necessary attention.

State works

The erection of soil conservation works at key positions, which is being undertaken by the Division of Agricultural Engineering is progressing systematically. This erection is preceded by the run-off control planning of catchment areas and the planning of all the farms involved. Operations were concentrated on the erection of new works in the Upper Orange catchment area, although no fewer than 15 damaged soil conservation works had to be repaired.

The following table shows the progress made:

Catchment area	New works completed		Repairs completed	
	Number	Value (R)	Number	Value (R)
Upper Vet River	1	192 196		
Sand River			3	14 000
Vaal River	1	30 106	1	9 000
Melkspruit	2	90 170		
Broekpoort-spruit	4	139 057	1	20 000
Vlekpoort River			7	21 000
Sundays River			2	7 600
Kariega River			1	13 700
Total 1973/74	8	451 529	15	85 300
Total 1972/73	13	765 759	17	149 317
Total 1971/72	9	401 071	9	115 979

Soil conservation research

Research undertaken by the Division of Agricultural Engineering at Aliwal North in the year 1973/74 once again confirms the following facts concerning erosion control in watercourses:

1. Where floods occurred, it was shown that trees in watercourses will not do. Common reed and Spanish reed still provide the best protection against floods and no substitute for these has yet been found. Trees prevent uniform reed growth and are the cause of water erosion.
2. Sheer donga banks can be bevelled effectively by natural means if reeds are planted at the foot of the banks of erosion gullies.
3. Jacks made of treated poles once again proved their effectiveness in protecting gully banks at bends. Their effectiveness can be increased by using wire netting and strands.
4. The after-care of soil conservation works is very important and yields good results. This includes: reed plantings, loosening of sediment, levelling of

the sediment surface, repair of bank erosion and maintenance of fences and suspended stock barriers in gullies for grazing control.

5. Bare patches and sparse veld have been reclaimed very successfully by packing these with grass which is in seed and then covering this with reeds. Outstanding results were obtained on a small scale where climax grasses were used.
6. Termites and rock-rabbits must be controlled.
7. Thousands of small, easily executed jobs can mean the difference between deterioration and improvement. These play an important part in the maintenance of a catchment area, and should not be under-estimated.

The Stock Reduction Scheme

The Stock Reduction Scheme entails considerable expenditure by the State, since compensation is paid for the number of stock withdrawn. The following table shows this expenditure up to the end of the 1973/74 financial year.

Year	Total expenditure in all areas where the Scheme applies (R)	
	Republic of South Africa	SWA
1970/71	611 853	
1971/72	7 906 502	321 900
1972/73	10 713 940	1 057 607
1973/74	9 046 140	1 292 931

The amount which has been spent thus far on the Stock Reduction Scheme will still rise considerably since participation by the participants who joined last only ends in February 1978.

The following is apparent from evidence from the areas where the Scheme applies:

- The veld of participants in the Scheme is generally considerably better than the veld of non-participants.
- Farmers in general are now far more veld-conscious (particularly with regard to the carrying capacity of their veld) than ever before.



The exceptionally heavy rains in 1974 did not promote veld recovery in all instances. The photo shows flood damage to a watercourse in the Carnarvon district

- There is much evidence from participants that they lost little or no income through participation in the Scheme and they are very pleased with the improvement in their veld.
- A positive change of attitude took place regarding more effective grazing management and the provision of adequate facilities for this purpose.
- The Scheme did much to speed up the physical planning of farms that have been withdrawn.

Although the data indicate that the veld registered under the Stock Reduction Scheme has improved considerably in certain respects, it would be dangerous to ascribe this improvement in composition and density solely to the application of the Scheme.

Plant surveys conducted during the past three growing seasons, involving both participants and non-participants, indicate, for example, that there was a drop in the total vegetal cover during the poor 1972/73 season, but that on the other hand there was a striking improvement in the veld during the summer of 1974. One of the main reasons for this was the exceptional rains during this period.

But apart from the above-mentioned climatic influences and other factors such as grazing, resting of veld, insect pests, etc., the plant surveys, which are conducted annually among a percentage of the participants in the Scheme, indicate an increasing improvement in the plant composition. According to these plant surveys there has been a considerable increase in the grass cover of both perennial and pioneer grass types during the past three years. In this connection the Karoo Region reports that the brushland has not shown the same degree of recovery, however, and in many cases has even deteriorated.

An outstanding result of the Stock Reduction Scheme is undoubtedly the overwhelming change in the attitude of farmers to correct veld management measures, and this is precisely where the greatest value of the Scheme lies.

Protection of cultivated land

The mechanical protection of cultivated land is now beginning to receive more attention than in the past.

This break-through is due to the fact that increasing attention has been given to regional hydrological planning during recent years. At the same time extension programmes were instituted in many areas to speed up the planning of run-off control. In the Highveld Region, for example, efforts have for many years been made to arrange for all applications for soil

conservation works to be preceded by comprehensive run-off control planning. These efforts were largely successful during the past year. The Highveld Region also reports that essential works for the protection of cultivated lands, which were planned in one financial year, will take five to seven years to complete at the present rate of surveying. Progress is thus being hampered by the staff shortage and not by inadequacies or a lack of interest.

Despite staff problems in all the regions steady progress was made with the mechanical protection of cultivated lands during the year under review. In the Winter Rainfall Region, for example, nearly 11 000 kilometres of contour banks were made during the past five years.

In the Highveld Region there was a slight decrease in the length of contours measured up, viz 1 200 km as against 1 400 km the previous year. On the other hand, a break-through was made in the construction of artificial waterways, 634 of which were measured up and 189 built and completed.

In the Transvaal Region about 800 km of contours were measured up during the year under review. It is very encouraging, however, that contractors are starting to show an interest in the erection of contours and watercourses. In one particular area in the Transvaal Region, for example, a contractor completed 97 watercourses to the value of R39 000. This amount is 80 per cent higher than that for the previous year.

In the Natal Region about 2 000 km of contour banks were measured up, but only 142 km of these were subsidised.

During the year under review a good deal of cultivated land in various areas was again withdrawn from cultivation following personal directions until such time as suitable stormwater furrows, contours and waterways are constructed. This has helped considerably to make farmers take the mechanical protection of fields more seriously.

Cultivation practices in fields which have been contoured leave much to be desired, however. Apart from the fact that the maintenance of contours is in many cases badly neglected, terracing occurs to such an extent on older cultivated fields that the problems created outweigh the advantages of the contour system.

As a result of the exceptionally early and favourable rainy season, winter erosion in the summer rainfall region was not as noticeable as in drier seasons.

But winter erosion again assumed serious proportions in the Sandveld on the West Coast and in the marginal croplands in the North-West.

The biological protection of cultivated land unfortunately receives little attention from farmers. In the Winter Rainfall Region, for example, ever smaller areas are being planted to restorative crops such as lupins every year. Today there is little talk of a crop-rotation system in the Swartland, for example. Virtually all farmers rather follow a "production system" than a crop-rotation system.

Grants in respect of the grass ley crop recovery scheme dropped from R15 684 during the previous year to R7 688 this year.

It was decided to abandon this scheme owing to the poor support received from farmers. Applications to participate already closed on 31 December 1971.

Soil conservation competitions and farmers' days

In the Natal Region 28 soil conservation competitions were held during the past year and eight soil conservation days were held on the farms of the winners. In the Pinetown extension ward a special farmers' day was organised for Indian farmers as part of their programme to demonstrate the building of bench terraces.

In the Eastern Cape Region 22 farmers' days, attended by 1 354 interested persons, were held. Although there were several different themes for these farmers' days, the idea of conservation enjoyed priority.

In the Free State Region 8 conservation farming competitions and 52 farmers' days were held, and in the Transvaal Region 76 farmers' days were held, at which 136 lectures and 44 demonstrations were given. These farmers' days were attended by 3 824 people.

The Winter Rainfall Region held 44 farmers' days, attended by 3 388 people.

In South West Africa the "Star" Competition of the SWA Agricultural Union was continued. Several one-star and two-star farms were designated under the auspices of farmers' societies and district unions. Field days and farmers' days were held on each of these farms. Two master conservation farmers were chosen during the SWA Agricultural Union Congress in 1973 and farmers' days were also held on these two farms, during which the farmers told their success stories to the other farmers.

CATCHMENTS

In Southern Transvaal Interdepartmental Action Committee for the Investigation, Proclamation and Planning of Mountain Catchments held three meetings during the past year and investigated two mountain

catchments. This led to the purchase of two farms in the Queens River catchment area. These farms will be used for limited afforestation and water supply.

The Eastern Cape Mountain Catchment Committee recommended that the following farms in the Post Retief area be proclaimed or purchased, namely Tamboekiesfontein, Bosrivier, Tiskloof, Didima and Mill Farm. Their combined area is about 2 400 ha and the ground is very steep and the covering poor and very susceptible to erosion.

Catchment planning

Despite staff shortages satisfactory progress is being made in all the regions which planned run-off control.

The Upper Orange Catchment has thus far been divided into 10 subcatchments, half a million hectares of which have already been pedologically, botanically and hydrographically investigated. This development is gaining encouraging support from both officers and farmers.

The Free State Region has given further attention to the planning of the three subcatchments Nuwejaarspruit, Egmont Dam and Slykspruit. These three subcatchments also form part of the Upper Orange Catchment. Progress in the erection of the proposed works is slow compared with the rate at which farms are being planned, however.

The Karoo Region is giving attention to five different subcatchments of the Upper Orange River. The planning work is in various stages of progress, but the survey and planning phases have been completed over 23,1 per cent of the Hendrik Verwoerd Dam's catchment area, which is situated in the Karoo Region.

The erection of the proposed works is progressing slowly, however: only 198 km of the proposed 821 km of internal fences and 39 of the 333 proposed stock-watering points have been completed.

In the Highveld Region, which also includes part of the Upper Orange Catchment, exceptionally good progress has again been made on an area basis with the planning of run-off control. In this Region the stage has now been reached where erosion control work is only measured up if it does not fit in with run-off control planning. By planning like this the real need for soil conservation works can be determined well in advance in respect of each subcatchment which is completed.

Attention is also being given to various run-off control areas outside the Upper Orange Catchment. In the Eastern Cape Region, for example, the Upper Gonubie River, Kat River and Boknes subcatchments are

ceiving attention, and in the Free State Region attention is being given to the Korannaberg catchment in the Vet River Catchment.

In South West Africa the planning of the catchments of the Omatako and Slang Rivers has now reached the stage where several erosion works have been measured up and farmers have already started erecting the works. The upper reaches of the catchments of both rivers are so badly eroded, however, that complete withdrawal of the eroded parts from grazing during the rainy season for a few years is absolutely essential, because otherwise the erection of soil conservation works will serve no purpose.

In the Transvaal Region catchment planning is not undertaken, but "target areas" within the framework of the smaller catchments are chosen in each extension ward and developed like catchments. There are at present 23 of these target or priority areas in the Region in various stages of development.

DRIFTSAND CONTROL

Coastal driftsands fall directly under the control of the Department of Forestry. This Department is constantly engaged in intensive research to control coastal driftsands. This research is aimed at stabilising driftsands.

The following table gives an indication of the problem of coastal driftsands in the Eastern Cape Region. (This Region, the Winter Rainfall Region and South-West Africa have the biggest problems with coastal driftsands.)

Area along the coast subject to active wind erosion

District	State land (ha)	Private land (ha)
1. Alexandria	6 124	240
2. Bathurst	30	25
3. Port Elizabeth	6	1 740
4. Humansdorp	200	6 300
5. Peddie	17	25

This table shows that Alexandria, Port Elizabeth and Humansdorp have the biggest problems with driftsand.

In the Eastern Cape a committee under the chairmanship of the Department of Forestry has been formed to co-ordinate activities in connection with the combating and control of active drift dunes. During the year under review a Regional Office was opened by the Department of Forestry at Humansdorp to give special attention to driftsands. In addition, a special driftsands programme has been launched in the Humansdorp extension ward with the object of fencing off all "active" driftsands within three years so that biological reclamation measures can be applied.

In South West Africa the Department of Forestry has had great success during the past year with research at Walvis Bay in connection with driftsands control. Artificial dunes are made with the aid of old fishing nets, which are hung at right angles to the normal wind direction, and these dunes are stabilised with various types of saltbush, which are simply irrigated with sea-water. The stabilisation of dunes with wooden barricades is also being continued.

SUBDIVISION OF AGRICULTURAL LAND ACT

Applications

There has been no decline in the number of applications for subdivision of agricultural land and for the passing of undivided shares in agricultural land. Agricultural land continues to be needed for the township development and other non-agricultural uses and there is a steady stream of testamentary dispositions which are submitted for approval.

It is striking that applicants, particularly land surveyors and attorneys, are fairly strict in vetting applications and that mainly those that have a chance of succeeding are submitted for consideration.

As Table 1 shows, 74 per cent of all applications were approved, which is in keeping with the trend of the past three years.

TABLE 1 - Number of applications dealt with under the Subdivision of Agricultural Land Act: 2/1/1971 - 30/6/1974

Period	For agricultural purposes only				Agriculture and other non-agricultural purposes				Withdrawal from agriculture for township establishment				Approvals		Total Rejections		Total Finalised
	Approvals		Rejections		Approvals		Rejections		Approvals		Rejections		Num-ber	%	Num-ber	%	
	Num-ber	%	Num-ber	%	Num-ber	%	Num-ber	%	Num-ber	%							
2/1/71-30/6/71	246	73	92	27	74	54	65	46	11	92	1	8	331	67	158	33	489
1/7/71-30/6/72	567	79	151	21	129	56	100	44	29	97	1	3	725	74	252	26	977
1/7/72-30/6/73	494	83	99	17	91	63	53	37	74	94	5	6	659	81	157	19	816
1/7/73-30/6/74	520	78	148	22	105	50	103	50	90	98	2	2	715	74	253	26	968
Total	1 827	78	490	22	399	56	321	44	204	90	9	10	2 430	74	820	26	3 250

Where non-agricultural use of the proposed subdivisions is envisaged, the percentage of applications that succeed is considerably lower, namely 56 per cent.

Subdivisions for agricultural purposes only

In view of the fact that 40 to 50 per cent of the farm units in the Republic are already smaller than the minimum unit for subsistence, it may be expected that only a limited number of applications for subdivision can succeed.

As a result of the excellent co-operation received from applicants, 78 per cent of the applications in this category were approved, mainly because farm units were being combined and a general improvement on the existing situation was being brought about. This is illustrated by the fact that the 1 827 approvals for subdivision for agricultural purposes represent 4 522 farm units (portions of farms for which separate maps and descriptions already exist), which belonged to 5 222 owners, but which were reduced to 3 932 farm units through consolidation and combination (Table 2).

farm units which ceased to exist individually as a result of consolidation are shown separately in Table 3.

TABLE 3 – Number of units (and area involved) combined with other farm units by consolidation
2/1/1971–30/6/1974

Period	Consolidation	
	Number of farm units	Area (ha)
2/1/71 – 30/6/71	104	48 471
1/7/71 – 30/6/72	420	108 151
1/7/72 – 30/6/73	325	87 317
1/7/73 – 30/6/74	484	164 142
Totaal		
2/1/71 – 30/6/74	1 333	408 081

Through the co-operation of the applicant therefore, 1 333 farm units were added to other farm units as against about 741 new farm units created by subdivision. This willingness of applicants to consolidate the various farm units they own or purchase has made it possible for a larger percentage of applications to be approved than during the first few months after the A

TABLE 2 – Change in the number of units and owners as a result of applications for agricultural purposes being approved: 2/1/71–30/6/74

Period	Applica- tions	Before subdivision			After subdivision		Increase or decrease in	
		Units	Owners	Area (ha)	Units	Owners	Units	Owners
2/1/71 – 30/6/71	246	514	541	314 169	645	676	+ 131	+ 135
1/7/71 – 30/6/72	567	1 412	1 535	877 475	1 222	1 412	– 190	– 123
1/7/72 – 30/6/73	494	1 184	1 373	882 322	989	1 228	– 195	– 142
1/7/73 – 30/6/74	520	1 412	1 773	1 238 915	1 076	1 244	– 336	– 529
Total								
2/1/71 – 30/6/74	1 827	4 522	5 222	3 312 881	3 932	4 560	–592	– 659

Ownership of land in undivided shares by various persons is common in spite of the personal problems that often arise in such a situation. As the information given in Table 2 clearly shows, the number of owners has dropped by 659, although just under 628 farm units are still owned by more than one owner in undivided shares.

The cases where farm units were subdivided without consolidation or combination are included in the data in Table 2, and for this reason the number of

came into operation. This trend towards enlarging farm units is not restricted to certain areas only.

However, the contrary appears from Tabel 4, from which a sharp increase in the number of units and owners is evident. This almost doubled number of farm units and owners illustrates the type of application which cannot be approved because the farm units are too small to ensure a living for more than one family.

TABLE 4 – Change in the number of units and owners in rejected applications for agricultural purposes: 2/1/71–30/6/74

Period	Number of applica- tions	Units	Existing Owners	Hectares	Requested		Increase or decrease in number rejected	
					Units	Owners	Units	Owners
2/1/71 – 30/6/71	92	100	111	62 588	223	220	+ 123	+ 109
1/7/71 – 30/6/72	151	233	238	144 756	299	413	+ 66	+ 175
1/7/72 – 30/6/73	99	131	144	75 162	315	431	+ 184	+ 187
1/7/73 – 30/6/74	148	196	265	110 242	270	503	+ 74	+ 238
Total	490	659	755	392 748	1 107	1 577	+ 447	+ 709

Subdivisions with a view to non-agricultural uses

During the past 3½ years 933 applications for the use of agricultural land for non-agricultural purposes were disposed of. The applications involved an area of just over 62 500 hectares. Of this, about 26 500 hectares were intended for small farms and residential smallholdings, 23 300 hectares for actual township development and 11 600 hectares for holiday resorts and other commercial or industrial purposes.

Leaf analyses of maize from the Christiana Extension Ward were undertaken, with the following results:

Nitrogen: Only 14 per cent of the samples showed adequate quantities of nitrogen.

Phosphorus: Despite the fact that phosphorus fertilising is recommended to farmers, only 18 per cent of the samples showed sufficient phosphorus in the leaves.

TABLE 5 — Non-agricultural use of agricultural land: Area involved — 2/1/1971 — 30/6/1974

	Agriculture and/ or residential		Resorts		Other use		Township development		Total	
	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
	Ap- proved	Re- jected	Ap- proved	Re- jected	Ap- proved	Re- jected	Ap- proved	Re- jected	Ap- proved	Re- jected
2/1/71 — 30/6/71	1 574	5 337	171	1 594	867	313	1 426	66	4 035	7 307
1/7/71 — 30/6/72	1 355	7 496	182	557	1 288	206	1 152	13	3 977	8 272
1/7/72 — 30/6/73	233	3 542	763	404	2 883	52	10 763	1 338	14 642	5 336
1/7/73 — 30/6/74	868	6 059	1 148	766	1 345	150	8 133	432	11 494	7 407
Total	4 030	22 434	2 264	3 321	6 383	721	21 471	1 849	34 148	28 372

According to the data in Table 5, it was mainly rural residence and holiday resorts for which approval was not granted, but approval was given for 6 383 hectares to be used for commercial and industrial purposes and for a further 21 471 hectares to be used for township development.

Because the more important development areas are situated in the eastern higher-rainfall regions of the country, the agricultural potential of this land is relatively high. An effort was made, however, to set aside the poorest agricultural land for urban purposes. Nevertheless, at least 800 hectares of irrigation land had to be sacrificed.

Looking at the whole picture, it is clear that the Act is making a substantial contribution to the more efficient use of agricultural land.

SOIL FERTILITY STUDIES

Soil analyses give a clear picture of the fertility level of the soils of the Vaalharts Settlement. The great variations found indicate that no general fertilising method can be applied; soil analyses are necessary.

Only 9 per cent of the topsoil samples showed zinc deficiencies, but 72 per cent were deficient in potassium.

Zinc: As may be expected, maize leaves show a great zinc deficiency.

Higher levels of fertilising for crops such as wheat and groundnuts under irrigation are now becoming popular. Fewer topdressings are applied to crops, even under irrigation, since farmers now prefer to apply all the fertiliser before or at planting time.

The special finely ground fluorapatite ore from Phalaborwa, known as phosphorus concentrate with 13 per cent P, has been found to be unsuitable in that form for phosphorus fertilising.

Soil acidity

It was found that with a rainfall of under 800 mm agricultural lime and gypsum leach out of a sandy loam (Enkeldoorn series) with equal rapidity. Lime raised the pH of the subsoil (200 to 400 mm deep) and the exchangeable calcium content, but gypsum did not effect similar changes.

Field trials showed that the minimum pH requirement for wheat and maize is 4,2 and that for peas, carrots and beetroot 4,8 to 5,0. The method developed for determining the lime requirement of soil, with the aid of which the pH of a soil can be raised to a certain value, is still giving satisfactory results in practice.

Sulphur status of soil

A preliminary investigation into the sulphur status (calcium phosphate soluble) of selected soils in the Winter Rainfall Region showed a satisfactorily high content for soils of the Msinga, Swartland, and Kanonkop series. The values in sandy soils of the Katarra, Sandveld, Fernwood and Mkambati series were generally low.

Studies on phosphorus retention

Soils of the Fernwood, Sandveld, Katarra and Mkambati series showed a low phosphorus retention capacity in general, with only slight differences between these series. High phosphorus retention values are found in the presence of organic layers in the Fernwood series (with high extractable aluminium values) and iron-rich horizons in the Katarra series.

Mineral deficiencies

Mineral deficiency problems in the Highveld Region are closely related to soil acidity. For instance, molybdenum deficiencies are widely found in acid soils. Zinc is generally applied as a precaution against deficiency.

Research has shown that calcium, magnesium and nitrogen imbalances and deficiencies are largely responsible for the fact that *red leaf* in the Hex River Valley has started to assume serious proportions. With a moderate calcium deficiency there is a 40 per cent incidence of red leaf and with an acute calcium deficiency the red leaf incidence is virtually 100 per cent.

It has been shown that berry-stem ring is chiefly the result of magnesium deficiency. This disease can be fully controlled by three leaf sprayings of magnesium.

Iron deficiencies in peaches and apricots can be very effectively controlled by two leaf sprayings in spring with the special iron chelate Fetrilon 5.

FERTILISING PRACTICES

For years after the planting of apple trees in new soil in the Western Cape, phosphate having been placed in the planting holes of some trees only and no further phosphate fertilising applied, the phosphorus content of trees which received no phosphorus at planting was 50 per cent lower than those that received phosphorus.

However, there were no significant differences with regard to spring growth, trunk diameter and the first crop between trees that received no phosphate and those that did.

With micro-irrigation schemes becoming more common, the application of fertilisers in irrigation water has been tested by the Fruit and Fruit Technology Research Institute. It was found, however, that solid fertilisers are very unevenly applied by this apparatus and that the quantities applied differed from the top to the bottom of the irrigation lines. This problem was overcome by making a concentrated fertilising solution first. If fertiliser is applied in this way a very even distribution is ensured and nozzles do not become blocked.

The broadcast application of fertiliser and lime on a contract basis on farms during winter is rapidly gaining ground in the Highveld Region. In the case of lime this type of service is particularly necessary in view of the large masses of material that have to be handled.

Although the use of lime as the basis for fertilising programmes is starting to gain ground, this product is still not used as widely as it should be. The problem of reducing soil acidity in the subsoil remains a pressing one.

Preliminary results from the Bethlehem Research Station indicate that milk production per hectare can be trebled and production per cow increased with veld fertilisation in this area. Similar results with an increase in production of beef steers have been obtained in the Bankenveld near Ventersdorp.

Despite a sustained extension campaign the value of well-planned fertilising programmes is not yet fully appreciated in the Eastern Cape Region. There are indications, however, that more and more farmers are having their soils analysed and then fertilising accordingly.

THE USE OF FERTILISER

During 1973, 2 308 459 metric tons (in physical terms) of fertiliser was used for the cultivation of agricultural crops. This quantity included 213 146 tons of nitrogen, 161 614 tons of phosphorus and 104 899 tons of potassium.

To counteract soil acidity, 828 311 tons of calcitic and dolomitic agricultural lime and 64 653 tons of slaked lime were used.

In the western part of the Highveld Region especially there is an imbalance between the quantities of nitrogen and phosphate applied for crop production. Nitrogen fertilising levels are often too low.

This year it was found that the use of certain high-grade mixtures in which urea is physically mixed (but does not occur as a compound) may lead to great

crop losses if the correct application practices are not followed.

Fertiliser advisory service

The continued interest of the farming community in the Natal Regional Fertiliser Advisory Service is reflected in the number of soil samples submitted for analysis. A total of 2 750 samples were analysed by the Cedara laboratory. During June 1974 the highest number of samples (425) over the past four years were submitted.

OTHER SOIL AND WATER STUDIES

Permeability to water in the Fish River irrigation area is expected to be lower when water from the Hendrik Verwoerd Dam is used for irrigation than it is at present with the water now being used. Standards have been worked out for use in calculating how much gypsum should be applied to the soil in order to keep the soil's permeability to water at a satisfactory level.

An intensive irrigation soil survey was undertaken on the 6 000 ha of State land in the Fish River area. The soil samples collected here were subjected to an intensive programme of analysis in order to evaluate their irrigability and gypsum requirements according to the standards worked out. These data are processed in a computer programme and used for planning the layout of plots on the State land which will later be made available to private farmers again.

The practice of using industrial and other waste water on agricultural land for irrigation is increasing and is likely to become even more important in future. Research on the matter has been started. To begin with, prominent soil series are to be described with regard to their permeability to water, particularly in the unsaturated moisture zone.

Following results obtained last year with the use of certain fertilisers in the control of root rot of maize, fertilising trials were undertaken in a number of places.

The results of the various treatments at the various places were so inconsistent that no conclusions could be drawn. It nevertheless appears that any form of fertilising leads to an increase in the percentage of root rot, but that this is more than compensated for by the increase in yield due to the fertilising.

The various fertilisers had no effect on the survival of the root pathogen *Helminthosporium pedicellatum* in the soil during the season.

Trials with systemic fungicides revealed that at the moment there is not much prospect of controlling root

rot of maize through the application of seed treatment preparations.

Promising results have been obtained by treating seeds with an isolate of *Bacillus subtilis*. It was established that balanced feeding under glasshouse conditions leads to a highly significant increase in the growth of maize plants and a reduction in the incidence of root rot. Furthermore, there was no change in the susceptibility of the maize plants to root rot as the plants became older.

Although constant drought caused a reduction in the incidence of root rot of maize, the mass of the aerial parts of the plants was significantly lower than that of plants that received sufficient water throughout their growing period. On the other hand, plants with infected roots clearly showed lower resistance to drought and heat.

It was also found that the better the resistance of a maize cultivar to root infection, the smaller the effect of such infection on the mass of the aerial parts of the plant.

An exhaustive study of the physical-chemical properties of certain Free State soils and the relationship between certain of these properties has been completed. Some of the main findings of this interesting investigation are the following:

- The degree of sodium saturation (exchangeable sodium percentage) cannot be deduced from the pH value alone.
- Highly significant correlations were found between the $\text{pH}(\text{H}_2\text{O})$ value, the $\text{pH}(\text{CaCl}_2)$ value and $\text{pH}(\text{KCl})$ values.
- The S value (or total exchangeable cations) was correlated with exchangeable calcium and magnesium to a highly significant degree.
- The saturation percentage showed a significant correlation with the clay or clay-plus-silt content. This therefore provides a quick semi-quantitative method of determining silt-plus-clay. However, the relation is affected by the exchangeable sodium and the particle size distribution of the sand fraction.
- Studies of the relation between the silt-plus-clay content and the permeability to water revealed that soils with a silt-plus-clay content of 50 per cent or more should be regarded as unsuitable for flood irrigation.

On the Oudtshoorn Experimental Farm it was found over a period of 50 months that the effect of

molasses on the infiltration rate of soil is already considerable after 12 months, reaches the maximum at 24 months and then declines rapidly. Sulphur seems to be the best after 24 months, and after 50 months the effect of gypsum is similar to that of sulphur.

It should therefore be possible to reclaim brack soils more rapidly with the aid of molasses than with other preparations, provided rapid leaching is possible.

Further results have confirmed that sulphur and gypsum are the most effective means of releasing calcium in the saturation extracts, provided the soil contains sufficient calcium.

ANALYTICAL SERVICES

The Soil and Irrigation Research Institute received 26 578 plant, soil, water and other samples on behalf of institutes and regional organisations of the Department, semi-Government organisations and farmers. At least 90 000 determinations were carried out.

In all 1 448 samples were taken under Act 36 of 1947 at all stock feed factories, mills, fertiliser factories, agricultural lime quarries and agricultural stock remedy manufacturers, and analysed in the laboratories of the Soil and Irrigation Research Institute.

About 98 per cent of these samples complied with the prescribed requirements.

NATURAL GRAZING

The rainfall of 689 mm for the past season was the highest during the 59 years for which rainfall records have been kept at Grootfontein and was almost three times the 267 mm recorded in the 1972/73 season. The rainfall of 252 mm recorded during March 1974 is the highest ever registered for a single month at Grootfontein.

The rains started earlier in the growing season than was the case during the past few years and were followed by further good rains. The result was unprecedented grass development in the Karoo. The grass that appeared was mainly *Eragrostis lehmanniana* (Lehmann lovegrass) and *Aristida congesta* (annual three awn) and is therefore not of a very permanent nature.

Owing to the favourable climatic conditions many seedlings of the strong perennial grasses such as *Themeda triandra* (red grass), *Digitaria eriantha* (finger grass), *Sporobolus fimbriatus* (common dropseed) and *Eragrostis curvula* became established. Another fairly good season should help the grass cover to become more firmly established.

The seed production in all grass species was very good last season. The large quantities of seed which became available should promote veld improvement.

Unlike the grass component, the scrub responded disappointingly. Much of the scrub died out during the preceding seasons and the percentage of scrub in the Karoo veld is still below normal.

Grazing management

An increasing number of farmers are realising the value of scientific grazing management and applying it to an increasing extent. The exceptionally good response of the veld to good weather conditions brought out the latent potential of many of the veld species and aroused new interest in veld management among farmers.

This interest was also reflected by the very large number of enquiries and plant samples received for identification. The short course on veld management and the farmers' days were generally very well attended.

During December 1973 fistula specimens of the veld were obtained with the aid of free-range animals for the first time. The camp in which the animals were ranging included doleritic rantjesveld and apron veld and was fairly dry at the time of sampling.

The main purpose of sampling was to investigate ways of identifying individual plant parts under the microscope; the results were interesting. The following table is an extract from the results:

Percentage composition of the diet of the various types of livestock on mixed grass and scrub Veld during December 1973

	Cattle	Dorpers	Merinos	Goats
Percentage of grass	98,5	85,3	95,2	69,3
Percentage of scrub and volunteer plants	1,5	14,7	4,8	30,7

Cattle ate about 47 per cent of green plant material whereas small stock ate 60 per cent. Unfortunately no plant surveys were carried out beforehand, so the relative availability of the various plant components cannot be given.

The scars of the drought are evident all over the Winter Rainfall Region from the large percentage of dead plants, and totally exposed surfaces are found over large areas. In the Port Nolloth area, which includes the Corridor farms, parts of Aggenys and the central part of the Ceres-Karoo, there are thousands of hectares where perennial vegetation has disappeared completely.

The deterioration of the veld was unavoidable here and even conservation farmers could not prevent deterioration under the unfavourable conditions. Analysis of the plant survey results in the North-Western subregion indicates that on average 2 per cent of the plant population died during the last few years.

*The effect of separate and combined
grazing of sheep and cattle on the cover and
composition of coastal fynbos of the
West Coast Strandveld*

Although these trials have been in progress for just over two years and the information available at this stage cannot be conclusive, interesting trends have nevertheless emerged from the comparative plant surveys.

It appears from the first results that:

Where veld is grazed by cattle alone the veld composition improves, but the vegetal cover decreases slightly.

- Where cattle and sheep are used together, there is a marked improvement in the veld composition and plant cover.
- Where only sheep utilise the veld the plant cover remains more or less constant, but the composition deteriorates.

Seed production

The seed production of a number of promising plants is being investigated with a view to reseeding the veld. A seed harvesting machine which works efficiently has been developed. In the course of this project it appeared that a considerable percentage of the seed is eaten by birds, ants and mice, the result being that it is not available for re-establishment.

Veld utilisation

There has been great progress with correct veld utilisation in the sweet bushveld areas. More and more farmers are starting to utilise grazing according to the basic principles of correct veld management, as they are

The bountiful rains in South West Africa enabled farmers, even in the Namib, to cut veld grass and make hay. Here it was mainly *Stipagrostis ciliata* that was cut





Asthenatherum mossamedense grows luxuriantly after the good rains in one of the shallow river beds in a semi-desert part of South West

applied very successfully at the Soutpan Experimental Farm.

Conditions were very favourable throughout the bushveld during the past season, and on many farms the grazing is slowly recovering its natural potential. There are, however, many farms where utilisation practices are as poor as in the past and where the grazing, notwithstanding the good season, is in a trampled condition and still at the pioneer stage.

Results of a four-year trial on the mopani veld of the Messina Experimental Farm confirmed that combinations of cattle and goats result in higher animal production per hectare than if cattle are run alone or goats alone.

Another important finding is that the mass data of the experimental animals over the past four years clearly

show that the performance of cattle improves steadily whereas that of goats declines. The deterioration in the performance of goats may be ascribed chiefly to the fact that the scrub grazing under the "goat browsing line" decreases gradually.

On the farm Vaalbank, where a three compartment grouping system with a carrying capacity of 1,61 hectares per small stock unit is followed, the basal and crown cover of red grass *Themeda triandra* increased from 7,1 per cent in 1973 to 14,3 per cent in 1974; all grasses increased from 18,8 to 57,6 per cent. The cover of unpalatable scrub dropped from 19,9 to 11,5 per cent.

In the Somerset East district many farmers are showing a great deal of interest in veld management. More than a third of the area of the grazing there has been rested for more than a full growing season during

the past year. Owing to the very propitious weather conditions it was possible to rest sufficient grazing on the smallest farms to give the palatable vegetation a chance to spread. A comparison between plant surveys carried out on the farms of four farmers who have applied a recognised rotational grazing system during the past 10 years and four farmers who have not done so shows that there is a perceptible difference in the increase in basal cover of palatable scrub and perennial grasses in the grazing of the first group.

This shows that where a recognised system has been applied for years the recovery of the veld is far more rapid than where no system has been applied.

In the Beaufort West district the practice of resting a third of the grazing area for a full year has been adopted by many farmers. The good rains of the past year have brought about a great improvement in the veld cover, but pioneer grasses such as three-awn species (*Aristida* spp.) and species of eight days' grass (*Enneapogon* spp.) were largely responsible for this.

In the Calvinia extension ward farmers have never been as conservation-conscious as they are now. This change in attitude may be ascribed mainly to the results obtained by the Stock Reduction Scheme. Virtually all the farmers feel that they used to keep too many livestock.

Radical Veld Improvement

In the R.V.I. programme (Radical Veld Improvement) in the Natal Region steady progress is being maintained with the introduction of both grass and legume species into the veld. This work is being done at Cedara and on a co-operative basis on widespread sites in Natal.

Veld management research at Dohne has indicated that good results can be achieved in sourveld by controlled selective grazing of desirable species. The growth rate and feed value of the grasses decline during the midsummer droughts that are a feature of the area, and animal performance suffers if high stocking pressures are applied during these periods.

A veld management system embracing rotational rests from January to January has given poor animal performance at Dohne, but could be useful for reclaiming denuded veld where a *Themeda triandra* seeding rest is important.

Stock Reduction Scheme

Vegetation surveys have been carried out to evaluate the effects of the Stock Reduction Scheme. These have shown a rapid recovery of the veld where

stock have been completely removed, but no appreciable effect where partial withdrawal has been applied.

Research in the valley bushveld of the Eastern Cape is aimed at determining the production potential of this important veld type (10% of the Eastern Cape) and at evolving suitable veld management systems for its utilisation. The edible shrubs in this area have been found to have a high nutritive value, but only a relatively small proportion of their foliage is available to livestock.

BUSH ENCROACHMENT

Encroachment of thorn bush remains a major problem in the coastal and drier savanna areas. In the inland there is an increasing awareness of the importance of goats in the utilisation and control of *Acacia karroo*.

Weedkillers, combined with burning and resting of the veld, have been used with success in the eradication of *Leucosidea sericea* (ouhout) in the Barkly East area.

Invasion of grassveld by karroid shrubs, e.g. *Chrysocoma tenuifolia*, is a problem in parts of the Molteno, Adelaide and Queenstown areas. Encroachment by these plants is a result of abuse of the veld and control therefore depends on the degree to which judicious management systems have been implemented. Controlled burning has been found to play an important role in the eradication of *Chrysocoma* in the Adelaide area.

Resin bush and rhenoster bush

In the Zuurberg range in the Somerset East district encroaching plants such as resin bush *Euryops oligoglossus* and rhenoster bush *Elyropappus rhinocerotis* have multiplied tremendously in recent years. Well-controlled burning of the veld after the January/February rains and even in early autumn appear to be the cheapest and most effective method of control. In this way veld which was previously covered by this encroacher was returned to a full stand of red grass *Themeda triandra*.

Swarthaak

(*Acacia mellifera*) is still the most serious encroacher on veld in the North-Western Cape and does great damage to grazing. An evaluation showed that with bush clearing and judicious veld management the grass increases rapidly and an open savanna-type veld is obtained.

Bekker nestlera (*Nestlera prostrata*) is beginning to assume alarming proportions in the Southern Free State. It is estimated that about 70 000 to 100 000 ha of veld in the vicinity of Bethulie is infested with Bekker

nestlera. Farmers are not giving sufficient attention to the control of this encroacher.

Slangbos

Stoebe vulgaris gives reason for concern on the sandy soils of the mid-highveld where it takes over on denuded areas and is difficult to eradicate. The incidence of slangbos is due mainly to bad veld management.

Camel-thorn bush

There have been efforts to control relatively large infestations of camel-thorn bush immediately below the Beervlei Dam. The present method of control is ineffective, however, and trials with Glyphosate are now being conducted.

The encroachment of bushes and shrubs such as *Acacia tortilis* (umbrella thorn), *A. grandicornuta* (brak thorn), *A. mellifera* (swarthaak), *A. erubescens* (geelhaak), *Dichrostachys cinerea* (sickle bush), *Terminalia sericea* (sandgeelhout) and *Grewia* species (wild currant) remains a very serious problem in almost all the Bushveld areas and will require much attention in future.

In the Thabazimbi district and in parts of the Ellisras district the bitter apple (*Solanacea spp.*) is encroaching on alarmingly large areas of grazing, particularly where high concentrations of impala occur. On most of the farms in the Northern Transvaal the farmers do not have sufficient camps and stock-watering points for effective grazing management.

VELD WEEDS

Jointed cactus

The Government has already spent more than R7 million on combating jointed cactus. During the past year 3 722 800 litres of spray were issued for this purpose, as against 5 161 200 litres the previous year.

New infestations are continually being reported and the area of properties on which infestations occur is increasing accordingly.

In the infested area of the Eastern Cape, which includes parts of the Karoo Region, the area of farms on which infestation occurred increased by 22 393 ha (1,37 per cent) during the past year. The total area of these farms is now 1 630 786 ha as against 1 212 157 ha shown by the first evaluation analysis in 1964. The inspection area has therefore increased by 418 629 ha (34,5 per cent) during the past decade.

About 824 034 ha or 51 per cent of the total farm area is actually infested. In June 1974, 80 per cent of the infested veld was under control, which represents a 4 per cent improvement as compared with the previous year. In the other regions scattered jointed cactus infestations are being kept under control.

Research with chemical, mechanical and biological control measures are under way with a view to the eradication of jointed cactus.

The weed-killer Tordon 3142 was found to be more effective than 2,4,5-T. This is a systemic killer and

Veld that has recovered beautifully after bush encroachment was successfully controlled. The photo was taken in the Vryburg district



effect on the plant is therefore much slower. In the Karoo Region it was found that 2,4,5-T.P. mixed with Tordon gives results just as good as those obtained with Tordon alone. It also costs less, is easier to transport and eliminates the danger of paraffin.

Cochineal and *Cactoblastis cactorum* attacked and statistically reduced severe jointed cactus infestations under favourable conditions.

Success in the control of jointed cactus depends to a large degree on the measures applied by the farmer concerned and on the extent to which he is able and willing to persevere with these measures.

Prickly pear control in the Eastern Cape and the Karoo Region is not progressing as desired, although 24 new applications for prickly pear spray were received during the past year.

Imbricate cactus occurs in 13 magisterial districts in the Karoo Region, where control is generally satisfactory. In the Transvaal and Free State Regions imbricate cactus is being controlled successfully, and promising results have also been obtained with biological control.

Silver-Leaf Bitter Apple (Satanbos)

An area of 40 454 ha on 151 Karoo farms is infested with this weed and the infestation is spreading rapidly.

A co-operative trial indicates that spraying with strong concentrations of Glyphosate and Tordon gives very good results.

The 28 infestations in the Eastern Cape Region have been sprayed and are under control.

Silver-leaf bitter apple occurs sporadically on farms near Immerpan in the Transvaal Region, and little has been done to control it.

The only noteworthy infestation in Natal is under control.

Setaria chevalieri, an exceptionally strong-growing grass which tends to smother planted shrubs, can be successfully controlled with a 3,0% Dalapon-water solution used as a foam spray.

Co-operative trials showed that spraying with a 0,5% water solution of "Roundup" gives good control of *Setaria chevalieri* as well as of *Lantana*, *Eupatorium*, *toratum*, bugtree, wild fern and American bramble.

Hakea occurs on 34 409 ha in the Eastern Cape. A total of 55 per cent of this area is already well under control.

Aquatic weeds such as water hyacinth, water fern and duckweed grow exceptionally well in water containing plant nutrients such as sewage and/or fertiliser. The Kariba weed flourishes even in very cold areas such as Bergville in Natal. These weeds are controlled mechanically as well as chemically.

American bramble occurs particularly in Natal tree plantations, where foresters are obliged to control the pest. Farmers appear to have lost interest in controlling the bramble.

Harrisia martinii control in Natal leaves much to be desired. The plant's seed is dispersed rapidly by birds and a serious situation is developing because this weed is very viable.

Eupatorium odoratum has penetrated the interior as far as the Chase Valley near Pietermaritzburg. It has



Pereskia, an extremely undesirable vine crop, occurs in parts of Natal



Spraying *Setaria chevalieri* with a foam preparation. This weed grass is a pest especially in plantations

been found, however, that this weed is gradually replaced by indigenous trees if left for a few years.

Wild fern is a serious problem in the coastal areas. Azulox, prepared specifically for fern control, appears to be the most successful killer in this case.

Nasella trichotoma infestations (New Zealand tuft-grass) are expanding tremendously in the Stutterheim and Barkly East districts. Since no suitable method of control is known this weed may eventually assume drastic proportions.

Spiny cockle-bur, large cockle-bur, Scottish thistle: Severe infestations of these weeds, which occur in all the windy regions, require continuous, organised attention and action.

POISONOUS VELD PLANTS

Vermeer bush

A chemical weed-killer was tested on a small scale against vermeer bush *Geigeria ornativa*. It was found that

vermeer bush plants react markedly to spraying with Tordon 225 and that the survival of plants decreases steadily until virtually no living plants occur as the concentration of the poison is increased. Only at the highest concentration (2% Tordon 225 solution) were there indications that the larger woody species were also affected. The grass cover showed no signs of dying.

Gousiekte

Research at the Swartrand Research Station near Ventersdorp has shown that while the veld grasses respond well to nitrogenous and phosphatic fertilizers similar responses are not apparent in the gousiektebush *Pachystigma pygmaeum*. Consequently fertilization of veld will probably result in a relative decrease of the poisonous material below a level which is lethal.

Senecio retrorsus remains an important poisonous veld plant in the Eastern Cape. Studies have shown that this species cannot be eradicated through veld management alone, but there are indications that it can be eliminated through radical veld improvement.

4. Field Husbandry

MAIZE

The record maize crop of the year under review is due mainly to the exceptionally good rainy season. The excellent rains not only produced a considerable increase in the average yield per hectare (it is estimated that the average yield on the farms of Whites was 2,5 tons per hectare), but also led to a considerable expansion in the area planted to maize. According to the opinion of Agricultural Marketing Research 50 per cent more land was planted to maize in the North-Western Free State and Western Transvaal. The estimated yields in these areas are 300 per cent higher than those of the previous season.

In the North-Western Transvaal the area under maize is still decreasing.

The very high yields obtained during the year under review in the marginal Western Free State and Northern Cape are expected to serve as a further stimulus to cash crop cultivation, at the expense of the production of forage crops and the planting of perennial grasses.

The high rainfall in various areas led to waterlogging and a serious nitrogen deficiency.

The wet conditions aggravated the weed problem and great deal and weed control problems will undoubtedly lead to an increase in the use of chemical preparations for weed control.

The flood damage along the Lower Orange River reduced the maize crop to about 50 per cent of the 1000 tons originally estimated.

The favourable rainy season meant that the yields obtained in trials were also exceptionally high. At the Indee Research Station yields of 11 375 kg per hectare were obtained.

The cool, moist autumn not only led to a delay in the harvesting of the maize crop but also stimulated interest in crop drying equipment. Bulk handling of the maize crop and the use of combines are becoming the standard practice on most maize farms.

Breeding and selection

During the year under review a wide range of local and exotic breeding material was planted for multiplication and crossing in the course of the departmental maize breeding programmes at Potchefstroom and Pietermaritzburg. Most of the

experimental plants were composites specially developed for the following characters:

1. General resistance to insects and disease.
2. Stalk and root strength.
3. Cold and drought resistance.
4. High oil, amylopectin, amylose and protein content.

The total available range of male sterile material showing resistance to *Helminthosporium maydis* (Strain T) was planted and multiplied.

Crossing material for the genetic study of protein and mineral inheritance in maize was very extensively combined, with a view to improving the quality of the maize grain.

A national sweet corn project was started with the multiplication of existing pure strains, exotic sweet corn breeding material and the maintenance of endosperm genetic material for the promotion of quality. A sweet corn yield trial with 12 entries was planted at Potchefstroom and at Ukulinga near Pietermaritzburg.

Selection and population development with regard to boil smut, cob-and-tassel smut and diplodia stalk rot were continued and excellent progress was made in the breeding programme for resistance to these diseases.

The organisation of a national maize breeding programme was finalised and maize breeding work will in future be included in the following key programmes, viz.:

1. Plant protection.
2. Biochemical qualities.
3. Morphological and physiological qualities.
4. Breeding for hardiness.
5. Population development and breeding methodology.

After nine years of intensive breeding research in the Natal Region an opaque-2 (high lysine) single cross hybrid (M37WO₂ x F2834 TWO₂) which yielded as well in trials in certain areas of Natal as the best resistant common hybrids has been developed.

The hybrids which produced the highest average grain yields at seven different sites in Natal were PNR353, SR52, R1E (Regop type) and PNR432. A record grain yield of 13 290 kg per hectare was obtained with the white hybrid PN353 in a co-operative trial in the Bergville area.

A large number of strains were tested at Vaalharts with a view to resistance to streak. A few breeding strains seemed to have great potential for use in streak-resistant hybrids.

Twenty commercially available maize cultivars were tested at the Sand-Vet Experimental Farm. Owing to the exceptionally good weather conditions three cultivars, namely A471W, SS754 and A212, produced yields of over 10 800 kg per ha.

Fertilising

Experiments at the Sand-Vet Experimental Farm showed that cultivars differ radically in their response to fertilising, particularly phosphorus fertilising. A cultivar like A471W produced good yield results throughout, although the phosphorus level varied, but other cultivars such as A212, DS23 did noticeably better as the phosphorus levels were increased.

Diseases and pests

Boil smut, caused by the fungus *Ustilago maydis*, occurred all over the Highveld Region, but the percentage of disease was low in comparison with the previous year and relatively little damage was done. The testing of breeding material for boil smut resistance was continued and the injection technique again produced very successful results.

Cob-and-tassel smut *Spaeceotheca seiliana* was present but infection with this fungus was relatively low. Resistance trials with breeding material and cultivars were successful and the results show that promising material is available.

An extensive programme for the evaluation of breeding material for resistance to streak was started in the glasshouse at Potchefstroom and is progressing well. A successful method of breeding the leafhoppers which carry the disease has been developed in order to create infection for experimental purposes. So far the investigation has shown that immunity and resistance are extremely rare in the available breeding material.

Maize stalk borer again occurred all over the Highveld. Although periodicity was evident in the incidence of moth flights and oviposition; oviposition in fields took place continuously from early October to the end of April. It was determined that impending infections can be easily and timeously traced by

following a programme of regular inspection of fields for the presence of eggs.

Field trials indicated that more than one spraying with chemical insecticides is required for satisfactory control of the maize stalk borer under conditions of severe infection. The regular examination of young plantings for eggs during the vulnerable growing period can help to ensure that spraying is carried out at strategic times when it is most necessary.

A type of sorghum borer (*Chilo* sp): This insect, which may be identical with *Chilo partellus*, which attacks grain sorghum in warmer areas, occurred in harmful numbers near Potchefstroom and Delareyville. Where this pest occurs together with the maize stalk borer, its seasonal history is being investigated.

WHEAT

SUMMER RAINFALL AREA

The wheat breeding team at Roodeplaat was appointed to take the lead in research on wheat under irrigation in South Africa. There are collaborators in all the ecological regions of the Department and in Mozambique, Swaziland and Mexico. New breeding material for testing is continually being received from Mexico and in 1974 three outstanding locally bred strains were sent to Mexico for world-wide testing.

Six strains were also submitted to be considered for commercial release, owing to their sustained performance in all parts of the country.

The cultivation of winter wheat under irrigation is expanding rapidly, especially on the Springbok Flats and in the vicinity of Dendron, Vivo, the Limpopo Valley, the Palala Valley and the River Settlement. An average grain yield of about 3 600 kg per hectare is obtained.

The cultivation of dryland wheat as a cash crop is gaining ground in the eastern part of the Free State Region. Wheat cultivation for grazing purposes is a popular practice in this area as well as in the south-eastern parts of the Region.

Breeding

At Bethlehem, the wheat research centre for the summer rainfall area, over 2 500 imported strains were evaluated and material with desirable characters was selected for the breeding programme.

In elite trials at Bethlehem, Reitz, Marquard and Clocolan South African-bred strains and imported strains compared well with standard cultivars. It again became obvious that producers of dryland wheat already have



A small combine harvester designed for reaping crops of winter grain on experimental plots

wheat cultivars with a high production potential at their disposal.

Because the wheat producer in the summer rainfall area has to contend with changeable climatic conditions, which produce periodic epidemics, breeding for wide adaptation, as with the cultivar Scheepers, is given high priority. The first results of this research are a few strains with resistance to stem rust; two were bred from Scheepers, one from *Triticum timopheevi* and the other from *Agropyron elongatum*. Those from *Agropyron elongatum* are at present in the first stage of multiplication. These strains have already been used in intensive crossing programmes with the aim of improving the baking quality of Scheepers.

The back crossing method is at present being applied successfully at the Bethlehem Research Station for the improvement of wheat. For instance, the winter wheat strains with *Triticum timopheevi* stem rust resistance were backcrossed to Flameks. The result was a number of rust resistant strains with good baking quality, better threshing qualities and yield potential and a longer growing season, which means that they are better adapted than Flameks in dryland conditions in the summer rainfall area. One of these strains is being multiplied for release at present.

Because of the continuous humid conditions in the Eastern Free State during maturation it was possible to apply selection from the breeding strains and imported material for germination in the ear, rust infection and shattering. Nine promising strains were multiplied with a view to possible release at a later date.

Good baking qualities were found in the strains used in the Bethlehem breeding programme, that is, in both the new breeding strains and the new accessions from overseas. Over 1 200 wheat samples were analysed for baking quality.

Experimental work with 18 wheat cultivars has shown that it would be hard to improve on Scheepers 69 as a dryland wheat cultivar for the Central and Western Free State. Scheepers 69 with a yield of 1 509 kg per ha of grain did significantly better than any of the other cultivars tested.

Many strains of bread wheat, durum wheat and biscuit wheat were tested at Vaalharts. Only one or two strains of bread wheat had a higher grain yield than the cultivar T4. Grain yields from the durum wheat and biscuit wheat strains were fairly high, but could not compete with those of the cultivar T4, which was used

as a control throughout. The durum wheat strain Lakota was the only one that did better than T4.

In the cultivar yield trials exceptionally high grain yields of 8 626 kg per ha were obtained from the cultivar T4. As much as 9 149 kg per ha was obtained from one replication of T4.

Planting methods

It was found in the course of an espacement and planting density trial at Vaalharts and Sand-Vet that wheat yields are not adversely affected by:

- Row espacements of 15 to 30 cm, and
- planting densities of 80 kg of seed per ha or more.

It was also observed that weed encroachment becomes a problem with row espacements of 45 cm and over.

At Riet River it was found that wheat irrigated directly after planting produced an 18 per cent poorer stand at six weeks after planting than wheat planted in wet soil. Wheat irrigated directly after planting also needed a second irrigation sooner and therefore required 15 per cent more moisture.

Irrigation

From a trial on irrigation levels it appears that the ideal method of irrigating the wheat cultivar T4 is the following:

1. Plant in wet soil (field capacity);
2. irrigate six weeks after planting;
3. irrigate again whenever 100 mm has evaporated from an American Class A evaporation pan.

Fertilising

Various nitrogen fertilising trials have revealed the following:

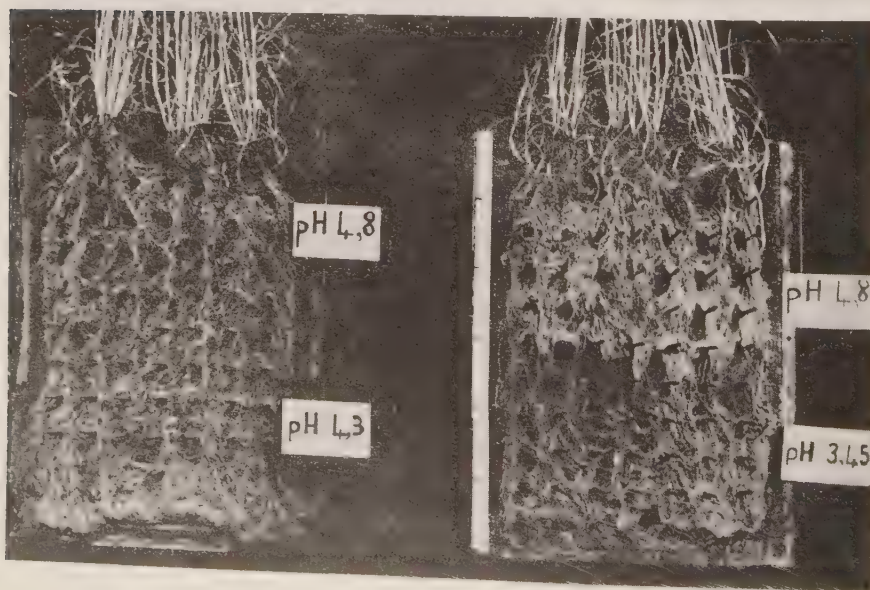
The ideal nitrogen level for Vaalharts on the Hutton Form of the Mangano Series for cultivar T4 is 120 kg to 155 kg of nitrogen per hectare. For Sand-Vet on the Hutton Form of the Shorrocks Series the figure is 80 to 110 kg of nitrogen per ha. For Glen on the Hutton Form of the Mangano Series (heavier phase) 100 to 130 kg of nitrogen per ha is ideal.

Quite the best combination of irrigation and nitrogen application for T4 at Glen is irrigation at an evaporation level of 100 mm six weeks after planting when 110 kg of nitrogen were applied per ha.

In South West Africa it was found that phosphorus levels of 15 to 60 kg per ha produced no significant increase in the yield of T4 wheat. Nitrogen levels as high as 180 kg per ha, however, produced an increase in yield which is economically justified above a nitrogen application level of 135 kg per ha.

Diseases and pests

Six systemic fungicides against stem rust of wheat were tested under various climatic conditions. On the whole triforine gave the best control of rust.



The effect of the acidity level of soil on wheat root development

Under controlled conditions triforine gave better control of rust at low day and night temperatures than high temperatures. This may mean that it will be more effective in the temperate climatic regions than in the warmer parts, and that applications will be more effective in winter than in summer.

Rust — Throughout the country stem and leaf rust is becoming an ever greater hazard for irrigated wheat such as T4, Inia 66 and Zambezi 11.

A large number of wheat cultivars and strains were therefore evaluated for resistance to rust. Some of those that showed promising signs of resistance and may therefore have good resistance to a changing spectrum of rust strains were included in crossing, selection and economic evaluation programmes.

Stunt (streak) — This virus disease is at present causing problems in parts of the Free State and North-Western Cape. The same virus may also cause maize streak. Since susceptible winter wheat enables the green hopper vector that infests maize in summer to survive, the cultivation of stunt-resistant wheat may help reduce the disease potential of maize.

With this in mind a trial was conducted at Port Elizabeth during 1973 and the following were the findings:

Cultivars such as T4, T8, Tosca, Frisko, Bella, Betta, Flameks, Kasteel, Skemer, Rheeboek, Belinda, Scheepers 69 and Betana showed good resistance to this disease.

Inia 66, Ciano, Tobari 66, Bajio 66, Muti, Nana, Scheepers, Charter, Red Victory, Bona, K20, Heemraad, Drommedaris and Sterling are fairly resistant.

Zambezi 11, Barta, Sekel, Penkop, Kenya Farmer, Janitor, Raven, Tosca and Lee Mida are fairly susceptible.

Tokwe, Punjab, T7, Gamenya, Kenya Sokkies, Sonop and Hoopvol are susceptible.

Weed control

In South Africa every year about 150 000 to 200 000 ha of wheat are sprayed with weedkillers after emergence. Pre-emergence spraying in many wheat-producing parts of the world provides good control of grasses especially, but also of certain broad-leaved weeds; this practice has not yet been investigated in South Africa. A field trial with the most promising preparations was carried out at the Makatini Research Station. A few preparations provided satisfactory weed control without having an adverse effect on the growth and reproduction of the wheat.

WINTER RAINFALL AREA

Breeding and selection

During the year under review 981 new pure strains were tested in yield trials at the Tygerhoek and Langgewens Experimental Farms. Of this total 679 strains were local selections, 128 strains were locally selected from Cimmyt-segregating material, 82 strains came from the 1971 International Spring Wheat Rust Nursery (ISWRN), and 82 strains from the 1972 ISWRN. 248 (25 per cent) of all these strains were retained for retesting, and 34 of the cultivars from the international collections were handed over for evaluation in the elite and accession trials conducted by the Field Crops Section of the Winter Rainfall Region.

The efficiency of the breeding programme was raised considerably by the fact that a very effective quality evaluation of both early and later generations has been undertaken by the Wheat Board for the first time.

Cultivar trials

A series of cultivar trials were sown in 21 ecological sub-areas. Of these fifteen were sown in the Swartland and seven in the Rûens. Each of these trials had twenty entries. The remaining six sown in the S.W.D., and Mossel Bay to Uniondale area differed in entry number from trial to trial.

These trials are of prime importance to extension work, enabling all concerned to familiarise themselves with the existing cultivars and to compare these with the new ones.

The yields of the two best cultivars, in both high and lower potential production areas in the Swartland and Rûens, are indicated below.

Swartland

Porterville — SST3 (34,8 bags/ha), Tosca (32,8 bags/ha)
Malmesbury — Inia (31,1 bags/ha), Gamenya (27,2 bags/ha)
Pools (dry area — low potential) — SST3 (26,4 bags/ha), Inia (26,1 bags/ha).

Rûens

Riversdal — Gamenya (24,1 bags/ha), Flameks (20,1 bags/ha)
Caledon — SST3 (33,2 bags/ha), T4 (31,2 bags/ha)
Swellendam — Inia (13,2 bags/ha), SST3 (11,9 bags/ha).

In the cultivar evaluation trial at Mossel Bay, Lee Mida with a yield of 18,98 bags per ha did the best, with Janitor second with a yield of 16,51 bags per hectare,

closely followed by Raven with 16,27 bags per ha and SST6 with 16,24 bags per ha.

Longstraw cultivars and lines

Twenty-three cultivars and lines were sown for evaluation at the Outeniqua Experimental Station. The highest yields was obtained by the line E 2105, a semi-dwarf type included in the trial.

The following gave the six best yield figures.

E 2105	28,85 (bags/ha)	Kasteel	23,86 (bags/ha)
Raven	25,89 (bags/ha)	W15	23,56 (bags/ha)
Gamenya	25,23 (bags/ha)	W8	21,93 (bags/ha)

The mean yield of 18,75 was surpassed by 10 entries. Bella yielded the poorest at 3,66 bags per ha.

Although rust was not a problem, most entries were infected to a small degree, especially Sterling and Lee Mida.

Dwarf and semi-dwarf cultivars and lines

This experiment included 19 entries. Most of the entries showed little sign of rust infection.

The following are the results of the four best entries.

Inia	32,71 bags/ha
10136	32,53 bags/ha
Sonalika	32,43 bags/ha
SST3	30,85 bags/ha

Nana with a yield of 21,13 bags per ha fared the worst. Ten cultivars produced above the average of 27,74 bags per ha. With the exception of Zambezi, Baijo and Sekel most cultivars showed little sign of rust throughout the growing season.

A cultivar trial was planted at the Oudtshoorn Experimental Station wherein 33 entries were compared. Of these 9 were unreleased lines and the remaining 24 released cultivars. Stem and leaf rust readings were negative, except in the case of Baijo and Inia where a high and low reading respectively was annotated.

The yield results showed a predominance of the short straw and semi-dwarf cultivars/lines over the long straw cultivars where only Kasteel, Lee Mida and line W31 were ranked amongst the first eleven. The best yields were obtained by the following:

SST3	— 60,6 bags/ha (70 kg)
72/367	— 58,4 bags/ha
72/384	— 56,4 bags/ha
Inia	— 56,4 bags/ha
Sekel	— 56,4 bags/ha

Of the three newly released dwarf cultivars — Nana, Muti and Sekel — Muti and Sekel were impressive, with Nana ranking only 19th in the trial. The most promising lines were the long straw W31, and the two semi-dwarf type 72/367, and 72/384.

A cultivar trial at the *Langkloof Experimental Station*, consisting of 28 cultivars and lines, showed as expected better yields from the long straw cultivars. Prolific producers such as Inia, SST3, Zambezi and Kasteel showed up poorly against the longer maturing cultivars where the following yielded best:

K20	— 23,7 bags/ha (70 kg)
Betta	— 20,2 bags/ha
T4	— 18,9 bags/ha
Barta	— 17,9 bags/ha
Lee Mida	— 17,2 bags/ha

Grazing trial

In this trial on the Outeniqua Experimental Farm 5 cultivars and strains, namely Lee Mida, K20, 68/506 69/136 and 68/8, were compared for grazing potential. Four treatments were applied, namely a control in which the wheat was allowed to go to seed normally, cutting during the tillering stage, cutting during the piping stage and cutting during the flowering stage. In the latter three treatments the wheat was allowed to go to seed after cutting.

None of these treatments made much difference to the mass of green matter produced, but the grain yield varied considerably according to the treatment.

In the control 68/8 did best with 29,24 bags per ha and Lee Mida (9,23 bags) worst. Grazing during the tillering stage improved the yield of K20 and Lee Mida so that the latter produced 17,92 bags per ha. 68/8 also yielded best (27,61 bags per ha) when grazed at this stage.

The reason for the improvement of Lee Mida is that the control was seriously infected with rust at an early stage. After the first cutting, conditions were less favourable for rust and the cultivar was not so badly affected.

Grazing during the piping stage reduced yields further, except in the case of 68/136, where the yield was slightly higher than with the previous treatment.

'8 again did best, yielding 20,14 bags per ha and Lee da worst with 14,49 bags per ha.

Flowering stage grazing was harmful to all the cultivars. Lee Mida did best under this treatment, producing an astonishing 10,32 bags per ha.

Cultivation methods

Because of the problems caused to wheat production of wind blown sand, especially along the coastal areas from Mossel Bay to George, as well as in areas of the Sandveld and Strandveld, a trial was laid out at Outeniqua to investigate the possibilities of zero cultivation.

Wheat was sown on a stubble land treated with herbicides Paraquat and Diquat. The wheat was sown in a no-till process without the soil being disturbed.

The result of this treatment, compared to the more normal method of cultivation, was pronounced. Where no tillage was practised an increase of two bags per hectare was obtained. Because of high cost of herbicides further experimental work is necessary before any recommendations can be made.

Time of planting

An experiment was laid out at Tygerhoek and Langgewens to ascertain what yield differences can be accredited to the time of sowing of existing short, medium and late maturing cultivars.

Two sowing times were adopted, the first being the normal sowing time in the district and then 3 to 4 weeks thereafter.

Yield figures for the second sowing at Langgewens showed an average drop of 53 per cent whilst that at Tygerhoek only fell by 20 per cent. These yield differences are due to climatic conditions late in the growing season. At Tygerhoek rainfall figures show conditions to be much more favourable for late plantings.

Diseases and pests

Rust identification was resumed and specimens from Makatini, Roodeplaat, Tygerhoek, Oudtshoorn, Welgevallen and the Swartland were identified. Strains 16, 21, 34, 100 and 232 were isolated from these specimens. A new strain 222, was found for the first time in material from Makatini and in rye from Langgewens.

As in 1972, the grain stink-bug *Macchiademus diploptens* occurred in pest numbers on small grain in the districts of Citrusdal, Touws River, Koo and on the

Koo highlands. Promising results were obtained with the chemical preparation monochrotophos, applied as an aerial spray, and parathion applied as a low-volume spray. The success of the efforts to control the pest varied according to whether farmers succeeded in identifying the critical period for spraying.

Weed control

Evaluation of lime herbicides for wild oat control in wheat was carried out in a field trial at Philadelphia. Benzoylpropethyl (Suffix), Avenge, L.S. 69-1299 and Methabenzthiazuron (Tribunil) gave yield increases of 83,0 per cent, 86,6 per cent, 73,7 per cent and 48,6 per cent respectively.

In dormancy studies on the wild oat it was found that both gibberellin and cold treatment under moist conditions significantly increased germination of the wild oat. Furthermore it was found that wild oat seed germinated very poorly or not at all at harvest, 28% after one year in the soil, 33% after two years and 57% after 3 years under natural field conditions.

COTTON

The 1973/74 season saw unprecedented developments in the cotton industry.

In the first place the price of cotton lint rocketed on the world market and the local price more than doubled. This great rise in the price of cotton elicited tremendous interest in cotton growing: the present crop of 188 000 bales of lint is more than double that of the previous season.

In the second place there has been a large-scale switch to mechanical picking on account of the new interest in cotton and the problems experienced with manual labour. Two ginneries, those at Marble Hall and Barberton, have already been converted to handle mechanically picked cotton.

Thirdly, the long-awaited Cotton Board has been established by the Minister of Agriculture to control seed cotton.

Furthermore, important official developments have furthered the interests of the cotton industry. The Wool and Textile Research Institute of the CSIR in Port Elizabeth has opened its new cotton laboratory. The Department of Agricultural Technical Services has set up a Cotton Action Committee and is recruiting a Cotton Working Party. The task of the Cotton Action Committee is to plan, co-ordinate and activate the cotton research programme, and the Cotton Working Party will be responsible for carrying out the research programme.

The Loskop Research Station has been made the cotton research centre. All cotton-producing areas will be served from this centre on a national basis.

Strength determinations on cotton lint are time-consuming and laborious, but all progeny at Loskop are now tested for strength. The programme consists chiefly in crossing American dwarf type with the most promising material from the Uppington breeding programme. Most of these crosses have already passed through the first selection cycle and an improvement in growth habit has been achieved.

About 20 000 bales of lint in the Loskop area were harvested with the aid of mechanical pickers during the past season. This switch has taken place within the space of a season. Last season a Departmental working team collected information on defoliation, the efficiency of pickers, damage and fibre quality and the economics of mechanical harvesting in comparison with manual harvesting.

Information on the shape of the plant and the extent to which this affects the picking process when machines are used was also collected.

Pests

The high rainfall during the past season made the application of pesticides very difficult. American bollworm *Heliothis armigera* counts were very high throughout the season, but red bollworm *Diparopsis castanea* only started to build up towards the end of the season.

Several promising preparations for the control of bollworm were tested, but endosulfan and carbaryl are at present still the best for controlling *Heliothis* and red bollworm.

Thrips trials at Vaalharts were concluded. It was found that preventive control measures are unnecessary in this area — corrective control where required is all that is needed.

Despite the high rainfall of the past season high infestations of common red spider *Tetranychus cinnabarinus* on cotton built up near Marble Hall and Groblersdal. Because the plants were planted very close together and were very lush on account of the abundant rains, it was impossible to control the spiders effectively.

The cover obtained with aerial spraying was completely ineffective because the preparation did not penetrate the dense foliage. A spraying trial with four preparations, namely Hostothion, Nuvacron with Galecron, Nuvacron on its own and Fundal Forte, showed that Hostothion produces the best results.

During February 1974 a nematode survey was carried out on cotton plots in the Vaalharts Irrigation Scheme. It was found that a third of the irrigation farms were infested with root-knot nematode. Other nematodes such as *Trichodorus*, *Tylenchorhynchus* and *Pratylenchus* also occur all over.

Crop results show that fumigation with ethylene dibromide doubled the cotton yield. An increase in yield is also obtained with aldicarb, but to a lesser extent. The use of oats as a rotational crop had no significant effect on the nematode population.

Weed control

In a field trial at the Groblersdal Research Station the effect of a number of established and promising new grass weedkillers and a number of weedkillers for broad-leaved weeds on various cotton cultivars was investigated. Cotton was resistant to most preparations, even at high levels of application. Some of these preparations are expected to be registered for use on cotton in the near future and may supply a need.

CHICORY

During the past year the estimated production of dried chicory root was again lower than the annual consumption of about 12 million kg. Although the yields were higher than last year, the quality was generally poorer because of the extremely wet conditions before and during harvesting.

The recent increase in the price of chicory root is expected to result in larger plantings.

Seed of 16 chicory cultivars was imported from several European countries in order to establish whether any of these cultivars being grown at present. Only one of the imported cultivars did better than the locally grown cultivars during the year under review. However, interesting differences in growth, root yield, quality and resistance to disease were observed and may be of great value in future selection programmes.

The possibility of producing good quality chicory seed locally is being further investigated. Seed production trials with five cultivars were carried out at the Grootfontein Agricultural Research Institute, in the Fish River Valley and at Aliwal North. Good seed yields were obtained. If certain practical problems can be solved, there is every chance that the Republic may become self-sufficient with regard to chicory seed.

The selection of chicory is undertaken in co-operation with the plant breeders at Grootfontein, and the possibility of developing a cultivar locally will be investigated as well.

Trials with an imported planter which plants chicory seed at any desired espacement were very promising. However, germination problems are being experienced, chiefly because of unfavourable moisture conditions which often occur during and after planting.

Owing to the continuous cultivation of chicory on certain fields the soil is deteriorating considerably. A rotational cropping trial carried out at Bathurst during the past two years showed that chicory yields can be increased if chicory is rotated with other crops, especially perennial grass and legume crops.

Weed control remains one of the big problems in chicory growing. Weedkiller trials have so far not been very promising, owing to the fact that chicory is related to many of the common weeds. Two promising weedkillers and several mixtures have been tested during the past year and it is hoped that a break-through will follow. These trials are continuing.

Because the harvesting of chicory requires so much manual labour, the possibility of developing a chicory harvester is being investigated. This work is being undertaken in co-operation with the Division of Agricultural Engineering. The industry would benefit if the lifting of chicory root could be mechanised.

A recent survey revealed that only 6 per cent of all chicory growers are seriously affected by stubby root. Although soil fungi play a part in the stubby root syndrome, any damage to the young plant roots may lead to the formation of stubby root.

No differences in resistance to stubby root were found between the four chicory cultivars tested.

PYRETHRUM

New plantings, especially those established by two farmers at Kidd's Beach and two at Bathurst in the Eastern Cape, have boosted pyrethrum production considerably. But actual production remains very small, chiefly because of two factors, namely, the exceptionally wet season which aggravated the weed problem, and the fact that most farmers are still hesitant about investing capital and labour in new plantings, notwithstanding the good demand for this product and the fact that there is a marketing organisation for pyrethrum.

The incidence of a fungus, *Fusarium solani*, on pyrethrum was established. During the past season up to 5 per cent loss of stand could be ascribed to this fungus, but in most cases the affected plants sprouted from the crown again. The exceptionally wet season contributed to the incidence of the disease and the loss of plants.

The testing and use of a mechanical pyrethrum combine designed by farmers was not very successful. However, the machine seems promising.

BUCKWHEAT

Seed of 33 buckwheat cultivars was imported from various countries in order to improve the quality of South African buckwheat. The quality of the cultivar grown at present is unsatisfactory for the export market. Seed of these cultivars was multiplied because in most cases only very small quantities of seed were received.

Two of the 18 cultivars planted in single rows at Ermelo produced 3 500 kg of grain per hectare, which is indicative of a very high yield potential.

OATS

A hundred strains of oats from various sources were evaluated at the Vaalharts Research Station. Several of these strains, and particularly Irwin, seemed promising in respect of hay and grain production, but could not beat the cultivar Alaska. In the cultivar yield trial Alaska yielded 5 720 kg per hectare, a very high grain yield.

BARLEY

Results from the yield trials in the Swartland and Rûens areas show that several barley cultivars and strains are differentially adapted in those areas. However, there are also a few types that show a wider adaptation. Although the best yield is generally produced by six-row barley, there are a few 2-row pure strains that can produce the same yields.

With the new pure strains tested under irrigation at Vaalharts and Grootfontein an increase in yield of about 26 per cent over the yield from Swanneck was readily obtained.

In a trial sown at Welgevallen the following results were obtained:

1. Where plots were trampled to simulate lodging, yield, hectolitre mass, percentage of plump kernels and straw yield were all significantly lower.
2. Spraying with Rogor for control of aphids, and thus possible of virus infection, produced a significant increase in grain and straw yield, but had no influence on the percentage of plump kernels or hectolitre mass.
3. Treatment for powdery mildew and *Rhynchosporium* had little effect on the different parameters.



Plots of winter grain at the Sandvet Research Station where cultivar, irrigation and tillage trials are done

4. A wetting treatment to simulate high rainfall during ripening in no way influenced the discolouration of the grain kernel.

Altogether 135 barley lines were evaluated under closed quarantine in glasshouses at Welgevallen and at Elsenburg 1 000 imported lines were planted out under open quarantine. Of these 53 have been selected for further evaluation and have been included in the 1974 Acquisition Trial. The rest were discarded because of disease.

The elite barley trial was sown at six localities — four in the Rûens (Heidelberg, Tygerhoek, Rietpoel and Napier) and two in the Swartland (Moorreesburg and Langgewens).

Owing to drought conditions the trials at Rietpoel and Napier were discontinued. The experiments comprised 35 entries, of which four released cultivars (Svanneck, Elsa, Elses and Comma) were used as controls and were replicated four times and sown on fallow land.

Of the 35 entries, 13 were discarded and of the remaining 21 the most promising were Clipper, B73/5 and B73/9. Seed of the B73/9 line is being increased during the 1974 season.

Seed multiplication — Barley multiplication is carried out at Elsenburg and Tygerhoek, for basic seed purposes for the industry and the multiplication of lines for further evaluation in regional trials.

Twenty bags of Swanneck and 10 bags of Elses basic seed were delivered to the Wheat Board at the end of the 1973 season.

Of the 125 barley lines tested at Vaalharts, only 28 meet the minimum values laid down. Despite the relatively late planting date an average grain yield of 5 618 kg per hectare was obtained from the best lines.

POTATOES

Production trends

The potatoes supplied by many producers on the Highveld, where about half the Republic's potatoes are produced, create marketing problems because of their poor keeping quality. These potatoes are unsuitable for redistribution or export.

Survey studies showed that keeping quality is determined chiefly by the extent of mechanical damage and the inherent resistance of tuber to rot. Sufficient information was obtained to improve the keeping quality of Highveld potatoes considerably.

Because the prices on these markets are poor during good production seasons when the Highveld has to market a large crop, the necessary stimulus to the production of potatoes with good keeping quality is lacking.

Measures to provide the necessary stimulus to the production of potatoes with good keeping quality are at present being considered.

During the past two years there was a sharp increase in potato production in the Free State. The area under cultivation increased by about 56 per cent from 1972 to 1974 and now stands at 621 hectares. The Free State will in future be able to play a significant part in supplying potatoes during the scarce season from May to September.

Seedling and selection

Newly bred South African cultivars have been gaining ground rapidly during the past few years. The contribution of South African cultivars to the Republic's total potato production is at present 42 per cent. The contribution of individual cultivars was as follows:

BP1 contributed 30 per cent, Van der Plank 10 per cent and 890/20 2 per cent. The contribution of Up-to-Date, which was bred overseas, is still 50 per cent, however.

The two new South African cultivars Koos Smit and R100 will also be available for commercial planting during the coming season. A further four Departmental cultivars, namely Sabie, 138/78, Buffelspoort Beauty and Sackfiller, will probably be released shortly.

Cultural methods

Basic research has shown that a high concentration of oxygen in the tuber medium results in a thick peel. Higher yields were also obtained with a high oxygen

concentration in the tuber medium. Well-aerated soil is therefore required to produce potatoes with a thick peel and resistance to mechanical damage. Field trials have confirmed the results of this basic laboratory research. Because lighter, sandy soils have better aeration they produce better potatoes than heavy, poorly aerated soils.

The nematode hazard in light soils can be effectively controlled either by sound rotational cropping practices or by fumigation.

Diseases and pests

The urgent need that arose during the preceding two seasons for more effective preparations against early blight and the leaf roll vectors (chiefly *Myzus persicae*) was underlined during the past season. Experimental results have shown that soil systemic insecticides provide control of leaf roll under normal field conditions until at least seven weeks after emergence. However, where there is a severe infection, that is, when high migrations of aphid populations occur early, little or no protection is obtained. It was also found that foliar spraying with demeton-s-methyl (Metasystox) is not only ineffective but may even increase the incidence of leaf roll in some cases. Trials have shown that better control is obtained with mixtures of contact and systemic preparations.

It was also shown that certain cultivars, including BP1 and Vanderplank especially, can be kept free of virus with the minimum control and that producers of table potatoes can therefore produce their own seed potatoes with very little trouble and expense.

Several preparations which do not contain mercury have been found to control dry rot,



Good examples of cultivars with which the National Potato Working Team is conducting trials at Roodeplaat: A represents tubers of Up-to-Date, B is BP1, C is Vanderplank and D is R100

Rhizoctonia and anthracnose (black rot) effectively. These preparations will fill the gap left by the withdrawal of the preparations that contain mercury.

Half-yearly surveys of potato cyst nematode in infested land in the Bon Accord irrigation area have shown that in the absence of the host crops during the period June 1971 to March 1974 the average number of live eggs per cyst has dropped by 93 per cent and the average number of live eggs per gram of soil by 96 per cent.

The presence of 2,5 live eggs of the potato cyst nematode per gram of soil causes a 40 per cent loss of yield in potatoes.

The North American potato cultivar Hudson, which was tested, showed resistance to potato cyst nematode.

According to further biological studies there are indications that only some of the live eggs in a cyst will hatch in the presence of a host plant and infest the plant. The younger the cysts the fewer of the eggs they contain will hatch. A smaller nematode population means that the crop will be larger than if the population had been higher, but there will be a bigger population in the soil after the harvest.

Although most cysts occur in the top 20 cm, they have also been found up to a depth of 50 cm.

Cold storage

Research by the Department of Agricultural Technical Services has been a major factor in making the cold storage of seed potatoes at the present rate of over R2½ million annually possible. This research was carried out by officers of the Department in co-operation with the Potato Board and the South African Seed Potato Growers' Union.

Bodies such as the Douglas Co-operative, the Kouebokkeveldse Moerkwekersvereniging and the Wes-Vrystaatse Droëlandmoerkwekersvereniging use cold storage more than any other concerns. There are also several smaller cold storage units throughout the Republic, which are growing rapidly in number.

The chief aim of cold storage is to preserve planting material in good condition for times of scarcity. From November to March certified seed potatoes are particularly scarce. In the past large quantities of seed potatoes had to be imported to meet the demand. The direct result of cold storage has been a drop in imports of over 50 per cent.

The latest findings show the following:

1. Seed potatoes should be placed in cold storage within a month of maturation, otherwise their performance will be increasingly poor.
2. Seed potatoes may be safely cold-stored for six months. After nine months of cold storage the performance of the seed potatoes drops rapidly and they produce poorer stands and lower yields.
3. Seed potatoes should never be allowed to start sprouting before they are placed in cold storage.
4. In cold-stored potatoes the ability to germinate and yield well drops rapidly if they are not planted within 30 days of removal from cold storage. Physiological aging is rapid after 30 days.
5. After removal from cold storage the seed potatoes should be kept at moderate temperatures (15° to 25°C) before planting.
6. For the best results plant uncut cold-stored seed potatoes 15 to 20 days after removing them from cold storage.

The cost of cold storing 30 kg of seed potatoes for six months is about 50 cents.

TOBACCO

Production trends

The total tobacco crop has dropped every year since 1969. The past season was characterised by exceptional hail damage in several tobacco-producing areas. This contributed largely to the estimated drop of nearly 2 million kg in the total tobacco production during 1973.

Production of leaf tobacco (in million kg) during the past 5 seasons

Year	Flue-cured	Light air-cured	Burley	Dark air-cured	Turkish	Total
1969	20,16	3,87	1,57	9,91	0,74	36,35
1970	19,65	2,91	0,72	9,19	0,59	33,06
1971	17,97	2,85	1,11	8,60	0,77	31,30
1972	16,55	3,08	1,26	8,38	0,76	30,03
1973 (Estimate)	15,36	2,70	1,44	7,89	0,90	28,29

The domestic consumption of tobacco, excluding snuff, rose by 9,9 per cent during 1973. This rise in consumption is regarded as exceptional. The normal increase is 3 to 4 per cent per annum.

In order to bring the tobacco grading system in South Africa into line with grading practices elsewhere in the world and with a view to loose leaf marketing, all flue-cured and air-cured tobacco is already graded according to stalk position.

As a result of the sharp rise in production costs and the decrease in the crop, the minimum selling prices were raised at the beginning of 1973. The increase for flue-cured and light and dark air-cured tobacco was 25 per cent and that for burley 30 per cent.

Exports of tobacco have dropped annually since 1969, from 13 098 000 kg to 8 331 000 kg in 1973. This decrease was caused mainly by an inability to make more tobacco available for export purposes owing to the great demand on the home market and diminishing local crops.

The 1973 crop will therefore be insufficient to meet the total domestic and export requirements.

Breeding and selection

Flue-cured tobacco

Strain X of the fungus which causes black shank in tobacco was distinguished from strains 0 and 1, and was therefore named strain 2. Resistance to strain 2 is determined by a single dominant gene.

Plants of tobacco cultivars resistant to strain 2 have been attacked by strain 1 of the same fungus on many tobacco lands. It has been possible to select plants

with some resistance to strain 1. Inheritance of resistance to this strain is evidently not a simple matter. Seed from selections with some resistance to strain 1 was used by a number of producers in 1973/74 and the breeding of resistant cultivars with a good yield capacity and quality characteristics is being continued.

The first selections were included in cultivar trials with flue-cured tobacco which were replicated in various environments. Promising results were obtained.

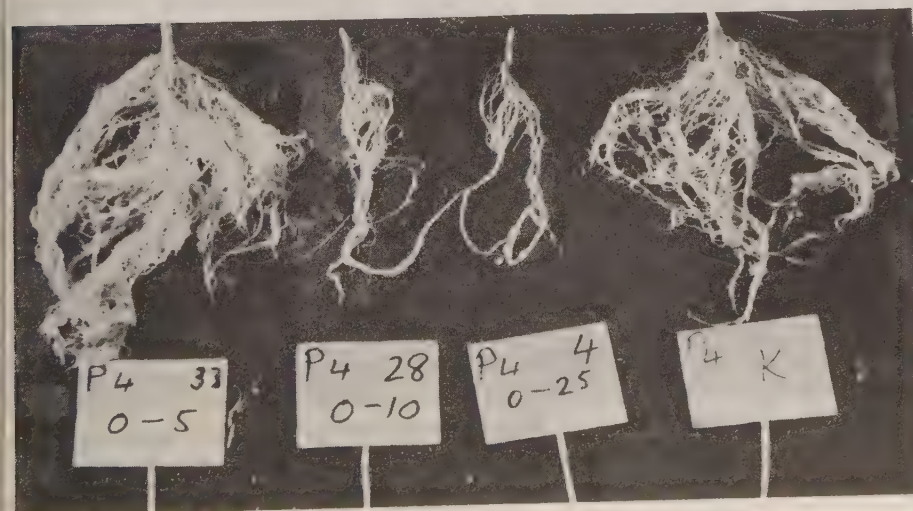
Burley tobacco

Two burley cultivars, known as CB31 and CB34, were released for cultivation. In cultivar trials at Burgershall and Ohrigstad these compared favourably with burley 21 as regards the yield and the quality of the cured tobacco. They are resistant to white rust, tobacco mosaic virus and strain 2 of the black shank fungus.

Air-cured tobacco

The improvement of both light and dark air-cured tobacco was continued. Seed of a number of improved light air-cured tobacco strains was made available to a number of producers. Selection trials with disease-resistant breeding strains showed promising differences in production. There were also indications that it will be possible to transfer resistance to strain 1 of black shank disease from the cultivar Maryland 609.

The cultivar 70CDL28 was released for the production of pipe tobacco. It is resistant to white rust, tobacco mosaic virus and red rust. In cultivar trials and under controlled cultivation it has shown that it can give good quality pipe tobacco under the right conditions.



The effect of chemical weed-control preparations on root development of tobacco: the plant on the far left was grown in soil where the upper 5 cm was treated with weedicide, the soil of the second was treated to 10 cm and the third to 25 cm. The plant on the far right grew in untreated soil



A tobacco leaf infected with ring-spot, a virus disease that is readily transmitted by insects

Turkish tobacco

The cultivar Elcatra was released for production and its seed is currently available through the usual channels. This cultivar is resistant to tobacco mosaic virus. Further improvement work is being done with a view to resistance to other diseases.

Resistance to nematodes

Strains already possessing the characteristics of flue-cured tobacco to a considerable extent remained comparatively immune from attacks by root-knot nematodes in soil heavily infested with this pest.

Planting methods

Flue-cured tobacco

Rows 100 cm wide, plants spaced 50 cm apart and topping depths aimed at 400 000 leaves per hectare once again gave the best results of the conventional espacement and topping methods for flue-cured tobacco.

Where planting methods which give 40 000 and 80 000 plants per hectare instead of 20 000 were used together with topping depths which increase leaf

numbers per hectare to as much as 800 000, the results varied: with such high plant populations and comparatively few leaves per plant, 560 000, 640 000 and 800 000 leaves per hectare gave the highest yield and income.

Increased populations of deeply topped plants offer possibilities because the growing period of the crop is reduced, harvesting is limited to a few pickings and sorting of the cured tobacco is simplified.

Light air-cured tobacco

An espacement of 100 cm by 50 cm and a topping treatment aimed at 400 000 leaves per hectare gave a high yield of good quality tobacco. There was no difference in response between the cultivars GS46 and GS72 to the different treatments.

An espacement and topping treatment such as that which gave good results with flue-cured tobacco also gave a high yield of good light air-cured tobacco.

Dark air-cured tobacco

Wider espacements and relatively deep topping are suitable for dark air-cured tobacco, and the highest number of leaves per hectare tested (300 000) gave the

ggest yield. A doubling in the leaf numbers per hectare through a doubling in the plant population increased considerably the yield, but also produced lighter tobacco. The possibility exists of obtaining higher yields of dark air-cured tobacco, particularly under irrigation, through greater plant populations and leaf numbers per hectare.

Stubble cultivation

Success was again achieved with flue-cured tobacco grown on uncultivated wheat stubble. Successful tobacco production straight after wheat was possible because soil fumigation before the wheat was planted was effective in controlling the root-knot nematode, because weeds and weed regrowth between the stubble were chemically controlled, and because the wheat's nitrogen requirement was adequately met.

Antitranspirants

The treatment of tobacco transplants with antitranspirants limits wilting after transplanting. They can be used to particular advantage to ensure that transplants do not become compacted by rain and also when the transplants cannot be hardened properly owing to climatic conditions.

Fertilising and rotational cropping

Nutrient trials with flue-cured tobacco with ammonia nitrogen and nitrate nitrogen showed no significant yield differences between the two nitrogen sources on the black clay soil of the Arcadia Series. In sandy soil the nitrate form gave better results than the ammonia form, however.

The success of the piecemeal application of nitrogen, spread over the early growing season, depended chiefly on climatological factors and the nitrogen supply capacity of the soil. It was established that the humic acid, fulvic acid and carbohydrate fractions of humus are decisive factors in the nitrogen supply of the Arcadia Series.

A start has been made with research on the trace element requirements of tobacco and with a study of the relationship between the nutrient status of soils in different tobacco-producing areas and the growth and yield of tobacco. At the same time methods of analysis are being standardised and refined so that fertilising recommendations can be made on a scientific basis.



A tobacco leaf infected with angular leaf spot. This is a bacterial disease that can cause much damage

Cultural methods

Sucker control

Two preparations which are registered for chemical sucker control in tobacco, Off-Shoot T and Sprout-Off, again gave good sucker control. Other preparations which also contain fatty alcohols, namely Fairtac and Sucker Plucker, gave results which were by no means inferior, however.

All these preparations are equally effective in much smaller quantities per hectare than those prescribed, provided they are applied at the recommended concentration on the apex of the tipped stem.

Induced maturation

Ethrel, applied to flue-cured tobacco, speeded up the ripening of the leaves considerably and gave the cured product a deep, attractive colour.

This effect of Ethrel is limited to tobacco plants which have grown normally, however, and whose leaves would have ripened naturally.

Utilisation of hail-damaged tobacco

Tobacco plants which were treated with a sucker suppressant and cut at an advanced stage of growth did not recover as well as untreated plants. This must be ascribed chiefly to the fact that primary suckers were destroyed by the suppressant. The secondary suckers were considerably less vigorous.

Irrigation

There were no significant differences between flood, sprinkler and programme-irrigated flue-cured tobacco. Actually, big differences could not be expected between methods of irrigation because irrigation was only used a few times owing to the very regular rains during the past season.

Diseases and pests

Black shank

The fungicide Dexon (dimethyl aminophenyl diazosodium sulphate) suppressed black shank on various types of soil for a considerable time. Crop rotation is important in the control of a soil-borne organism like this. Of a number of crops which were tested, only sunn hemp roots were unattractive to the organism.

Soil moisture conditions varying from wet to dry were much more conducive to the infection of tobacco

plants on contaminated soil than on soil which was kept wet.

Black root rot

An investigation showed that black root rot is fairly common in tobacco seed-beds and that this disease in the soil frequently causes unsatisfactory growth. A soil temperature of more than 27°C suppressed the disease, while a temperature of 20°C was very favourable for its development.

Leaf curl

It was found that the transmission of the virus which causes leaf curl in tobacco is not broken during the egg stage of the white fly, which is its carrier. Attempts to transmit the virus mechanically have so far been unsuccessful.

Nematodes

Nematocides remained phytotoxic longer during the colder months and on heavier types of soil.

Basamid was registered as a preparation for control of nematodes, weeds and fungus in tobacco seed-beds. The application of this preparation can save labour and time.

Insects in stored tobacco

Gordona was registered for use on walls, floors and ceilings of tobacco sheds and buildings. During trials it gave a long and effective control of tobacco insects.

Weed control

The weedkillers Planavin, Tillam and EL 175 gave good control of annual grasses and a few broad-leaved weeds. If applied according to instructions none of them have an adverse effect on growing tobacco. However, trials showed that Planavin in particular will inhibit growth if the tobacco is planted in treated soil layers.

Two of the preparations have already been registered and can be used to advantage by the tobacco farmer in his fight against weeds.

Harvesting methods and curing

Ripeness of flue-cured tobacco

The stage at which the producer of flue-cured tobacco on red alluvial soil usually considers his leaves to be ripe and harvests them is two to three weeks before the actual optimal picking stage of the leaf. This finding may lead to the production of better quality tobacco on this type of soil.

Investigating methods for flue-cured tobacco

Good results were once again obtained when four or five leaves per picking were harvested, as against seven leaves per picking. In this trial plants spaced 50 cm in the row and having 16 leaves per plant gave better results than plants spaced 25 cm in the row and having 8 leaves per plant.

The top-leaves of 16-leaf plants were considerably smaller than those of 8-leaf plants, however, and the harvesting of the latter was finished a good deal earlier.

Investigating methods for Turkish tobacco

From trial data gathered during the year it appears that the cutting and curing of whole plants (whole-plant harvesting) of Turkish tobacco gave a considerably lower volume and yield per hectare than where the leaves were picked and cured as they ripened. This advantage of the conventional method disappeared, however, where half or more of the leaves were picked and the rest then cured as whole-plant harvesting. This procedure could save a considerable amount of time and labour.

Whole-plant curing of tobacco

The smooth appearance of flue-cured tobacco leaf which is cured in bulk was originally less acceptable than the crinkled leaves of conventionally cured tobacco. A more crinkled appearance is obtained, however, by drying the leaves when they are placed in the frames.

An effective curing schedule for flue-cured tobacco which has been grown and ripened normally was worked out. This schedule is a most useful guide to the whole-plant curing of tobacco and allows for the fact that leaves from different positions on the stem differ in curing requirements.

Leaves of flue-cured tobacco which come out of the curing process flue green, and whose green colour is not due to physiological immaturity can be improved to an attractively coloured tobacco with the aid of bulk curing facilities. With a leaf moisture of 24 per cent the leaves are kept at 38°C and 90 per cent relative humidity for 4 to 5 days. This treatment could possibly replace the lengthy fermentation processes to which Turkish tobacco is usually subjected.

Quality studies

The percentages of sugar, starch, polyphenols, pectic acid and moisture retention decrease from the higher to the lower grades of flue-cured tobacco, whereas the percentages of total nitrogen, alkaloids, waxes, oils, ash and filling power increase. However, new tobacco grades

allow for differentiation between leaf positions on the stalk.

The percentages of potassium, sugar, starch, chlorogenic acid and moisture retention increase from the lugs to the cutters and are low again in the top leaves. Alkaloids, waxes, oils and filling power decrease from the lugs to the cutters and are higher in the top leaves. Total nitrogen and chlorine increase from the bottom to the top leaf positions.

Soil and plant analyses

All told 6 730 soil, water and plant samples were analysed during the season. This represents 41 556 analyses. These analyses were chiefly of leaf samples from trials under registered projects, where the evaluation of quality characteristics would have been impossible without the results of chemical analyses.

In addition, numerous samples of soil and water were analysed and recommendations were made to producers concerning fertilisation and other aspects of tobacco cultivation on the basis of the analysis results.

GRAIN SORGHUM

Further trials were carried out to determine the effectiveness of insecticide sprays against grain sorghum aphids and their effect on their natural enemies. All the insecticides gave very good aphid control, but had catastrophic consequences for the natural enemies, with the result that rapid resurgence in the aphid numbers occurred.

Only endosulfan sprays did not result in a high mortality rate among natural enemies and the increased use of this preparation is strongly recommended.

Experiments were also carried out to determine the minimum dosage for control by the systematic soil treatment disulfoton. This preparation can solve the whole problem of aphids in grain sorghum, but is still too expensive.

Interesting experiments have been carried out with an insect growth regulator, one of a group of preparations which have sparked off world-wide interest because of their low toxicity to vertebrates. Aphids treated with this preparation at first show no ill-effects, but before maturity more than 90 per cent of all the young aphids die. Moreover, those that do reach maturity are for the most part sterile. Preliminary experiments indicate that the natural enemies are not much affected by this preparation.

SOYA-BEANS

Good producer prices resulted in considerable expansion in the areas planted with soya-beans. This increased interest in soya-beans, together with a particularly favourable rainfall pattern, resulted in a record crop of almost 15 000 tons of soya-beans. Very high yields were achieved on many farms.

Breeding and selection

A number of new cultivars were evaluated in cultivar trials during the past season. The early cultivar Kent did very well. The high yield potential of the cultivar Geduld was again demonstrated during the past season. Yields of up to 1 000 kg per ha were obtained from large-scale commercial plantings.

Before soya-beans can be successfully grown the seed must first be inoculated with *Rhizobium* bacteria. Plants which have formed proper root nodules supply much of their own nitrogen requirements.

Research has indicated that different soya-bean cultivars are not always nodulated equally successfully by the same *Rhizobium* strain. Wide-spectrum strains were, however, used by the Plant Protection Research Institute in inoculants, which are effective in the cultivars commonly grown.

Diseases and pests

The nature and extent of bacterial diseases in soya-beans were investigated. Although no soya-bean plantings could be found which were free of bacterial diseases, it would appear that bacterial diseases have not yet reached the stage where they could have a serious effect on the soya-bean industry.

If the production of soya-beans were to increase considerably, bacterial diseases might perhaps also increase considerably. Timely preventive measures should be taken by using disease-free certified seed. Attention is being given to laboratory techniques to certify seed as disease-free.

A study of the soya-bean mosaic virus has begun. This seed-borne virus is of considerable practical importance. Intensive purification of the virus and the production of anti-serum have begun.

DRY BEANS

Particularly favourable producer prices resulted in great interest being taken in dry bean production. The discovery by marketing missions that a great demand for coloured bean types exists in the East has greatly encouraged interest in the growing of this bean type.

Breeding and selection

Altogether 180 breeding lines of the Michigan type of dry bean are being multiplied for inclusion in cultivar trials. This breeding material was inspected during the past season by a representative of an overseas canning organisation and elicited very favourable comments.

As a result of the high rainfall during the past season severe infections occurred in the dry bean plantings, the result being that it was possible to select very effectively for resistance to disease.

Intensive glasshouse studies of the more important small white dry bean cultivars were made during the past season in order to determine the climatological adaptation of these cultivars. In an investigation of the effect of various growth medium temperatures on the development of the plants it was found that a low growth medium temperature of 15°C considerably retarded growth and development. A growth medium temperature of 35°C promoted growth at first, but at 30 days after planting a growth-suppressant effect was already noticeable.

Although dry beans are legumes, the results show that inoculation of the bean seed with *Rhizobium* bacteria does not always produce the desired effect. In contrast with soya-beans, nodulation in beans is often poor. At this stage it cannot be said that inoculation can be relied upon to supply the plants' nitrogen requirements. When fertilising beans, provision should therefore also be made for nitrogen applications.

Diseases and pests

Although a high percentage of dry bean plantings in the Transvaal were infected by bacterial diseases during the 1973/74 season, only a few plantings were so badly affected as to result in drastic crop losses. The importance of the use of disease-free certified seed was striking.

The indications are that the pathogen *Pseudomonas phaseolicola* was the most common.

Serological methods could be successfully used for the quick identification of bacterial isolates from infected plants and seed samples. Although some success has already been achieved with techniques of indicating the percentage infection of certified seed, problems are still being experienced in using those techniques on a routine basis for large seed lots.

GROUNDNUTS

Very large areas were planted with groundnuts. The high rainfall, especially during harvesting, greatly hampered the harvesting process. The ever-increasing



portage of labour made the situation, even more difficult.

About 90 locally bred lines were tested this year in field trials at Potchefstroom and Vaalharts. One Natal Common line did especially well for the second successive year, on dryland as well as under irrigation. This line has a considerably higher yield and better quality than the traditional Natal Common.

Trials carried out by the Plant Protection Research Institute during the past three years have shown that groundnuts in most groundnut areas are fairly well infested by *Rhizobium* bacteria occurring in the soil and that these bacteria can supply the plants' nitrogen requirements under extensive cultivation practices at very low fertiliser applications.

Varying irrigation levels, with groundnuts as the experimental crop, have confirmed the results of the previous years' investigations, i.e. that maximum yields are obtained with a 50 to 100 mm rate of evaporation as a basis for irrigation.

Leaf-spot diseases such as *Cercopora* and *Phyllosticta* were particularly severe during the past season. The latter disease especially could not be properly controlled with sprays available.

Botrytis cinerea (grey rot) also caused much damage, especially in the cooler parts of Natal.

SUNFLOWER SEED

Sunflowers have attained full status as a principal crop. Under particularly favourable rainfall conditions, which were experienced during the past season, sunflowers

would normally have played a subordinate role vis-à-vis other cash crops such as maize and grain sorghum. But the record crop of the past season shows that sunflowers, are now accepted as an economically competitive crop. The high rainfall, however, resulted in considerable losses through disease.

Altogether, 113 test sunflower hybrids were bred during the past season. These experimental hybrids will be evaluated in yield trials during the coming summer. About 70 inbred lines which will be used for the breeding of a further series of experimental hybrids, were developed, from new sources. Pure breeders' seed of the open-pollinated cultivars Peredovik and Smena were multiplied.

Valuable new breeding material was imported from overseas for introduction into the local breeding programme. Particular attention was given to material with proven disease-resistance genes.

In fertilising trials it was again demonstrated that sunflowers are particularly sensitive to aluminium toxicity in soils with a low pH. Most spectacular results were obtained after applications of lime to acid, sandy soils traditionally regarded as unsuitable for sunflower cultivation. Boron deficiency symptoms were found in sunflowers in leached soils of that kind.

The effect of pre-emergence-applied weedkillers on various sunflower cultivars was investigated in field trials carried out in various soil series. The crop showed a high degree of resistance to both grass and broad-leaf weedkillers.

ARTIFICIAL PASTURES AND FORAGE CROPS

LUCERNE

During the year under review there was a considerable increase in the area under lucerne in the Eastern Cape Region. In the Barkly East district, for instance, almost 98 per cent of the farmers have already established lucerne.

On the other hand, a considerable drop in lucerne production is expected in the Lower Orange area. Most of the lucerne fields, which are planted mainly on low ground, were silted over by the 1974 floods. New plantings are being hampered by the fact that the reclamation work is slow and the planting time for the present season is almost past.

Floods did a great deal of damage to lucerne fields in the Karoo Region as well. The re-establishment of the damaged fields and the planting of new fields are restricted by the great shortage of lucerne seed, as is the case along the Lower Orange as well.

In the Karoo the improvement of lucerne through breeding is still progressing well.

Diseases and pests

The lucerne earth flea *Sminthurus viridis* and the black sand mite *Halotydeus destructor* are still regarded as the chief pests on artificial pastures in the Winter Rainfall Region. These two pests lend themselves very well to biological control and a reasonable degree of success is being achieved where imported predator mites have been released.

The lucerne earth flea predator *Bdellodes lapidaria* established itself so well in a plot of artificial subterranean clover at Caledon that large numbers were available during October 1973 for artificial distribution to other infested pastures. The slow natural spread of the mites (about one kilometre since release in 1971) necessitates such action.

Neomolgus capillatus, another predatory of the lucerne earth flea, was imported from Australia in 1971 and has adapted itself fairly successfully at its first release site at Stellenbosch. However, its numbers are not yet large enough for further distribution from this point to be undertaken.

Anystis sp., a predator of the black sand mite imported from Morocco during 1969, has adapted very well to conditions at Stellenbosch. This predator holds great promise for the biological control of both the black sand mite and the lucerne earth flea. *Anystis* numbers increased to such an extent at Stellenbosch that

sufficient insects were available for distribution to three farmers in the Caledon district in October 1973. Further distribution is planned for the coming season.

LUCERNE-GRASS MIXTURES

Although the 1973 growing season was a poor one as far as production from pastures is concerned, a mixture of lucerne, medic, subterranean clover and grass carried eight ewes and their lambs throughout the winter in an experiment at Riviersonderend.

There was no significant difference in the liveweight gain between pastures stocked at four and eight ewes per hectare during this period. Lambs were marketed at 100 days at a mean carcass mass of 17,5 kg. There was also no significant difference in the carcass mass of lambs from the lightly and heavily stocked pastures in winter, nor did the number of lambs marketed differ significantly.

It appears that even in a bad year these pastures can be safely stocked at four ewes per hectare.

As far as the composition of the pasture is concerned, the only one of the various grazing treatments that produced a significant effect was resting the pasture during the 1972 season. Areas that had been rested for hay or forage had significantly more ryegrass than areas that were grazed in the 1972 growing season. The favourable conditions in 1972 resulted in rapid growth in the rested camps and it was not possible to make hay before the grasses had smothered the legumes.

LEGUME-GRASS PASTURES

The planting of legumes as forage crops and legume-grass mixtures for grazing is increasing. But the establishment of legume-grass mixtures is expensive and if the legume component has not been properly nodulated by *Rhizobium* bacteria it cannot fulfil its function of supplying nitrogen for the pasture.

The Plant Protection Research Institute has effective *Rhizobium* strains available at present for virtually every legume planted in pasture or as a forage crop. These strains are supplied to manufacturers of inoculant who prepare high quality inoculants for crops that are grown fairly commonly.

Panicum maximum (Nanyuki) and *Cenchrus ciliaris* (Molopo) have been tested over a period of four years at the Roodeplaat and Rietondale Research Stations for their ability to combine with the following legume crops:

Desmodium uncinatum cv. Silverleaf, *D. intortum* cv. Greenleaf, *D. sandwicense*, *Macrotiloma axillare*

ously *Dolichos axillaris*), *Glycine wightii* cv. *er* (previously *G. javanica*), *Macroptilium purpureum* cv. *siratro* (previously *Phaseolus purpureus*) and *Lotononis bainesii*.

A mixture of *Lotononis bainesii* and *Macroptilium purpureum* cv. *siratro* was also included.

To serve as a basis for comparison with the legumes, pure stands of the grasses were also included in the trial, both with and without a nitrogen treatment of 100 kg of nitrogen per ha each year.

Over a period of four years *siratro*, glycine and *desmodium sandwicense* yielded the best results with the grasses. Yields of crude protein were higher than those obtained from pure grass with the same nitrogen fertilisation, but yields of dry matter were slightly lower.

The results show clearly that the legume crops *desmodium* and *siratro* can be combined to advantage with *Thembaeus ciliaris* and *Panicum maximum* for the production of economic mixed pastures.

Trials with the subtropical legume crops greenleaf *desmodium* and *siratro* in the southern coastal area of the Eastern Cape Region showed that this mixture is very promising.

A further 10 hectare plots were planted to mixtures of the above legumes and grasses and the value of the pastures was determined by using livestock. One plot near Kei Mouth was planted to *desmodium*-Rhodes grass and evaluated with young Friesland steers. The steers showed an average mass gain of 0,5 kg each per day over a period of 120 days at a stocking rate of 1,2 large stock units per ha.

The *Siratro*-Rhodes grass pasture produced an average increase of 0,4 kg per day over the same period at a stocking rate of 1,5 large stock units per ha.

Over a period of 120 days oxen rest on artificial pastures showed an average mass increase of 11 kg more than oxen run on the veld.



Experimental plots of cocksfoot *Dactylis glomerata* at Cedara where the yield of local and imported cultivars is determined

CLOVER

After several years of evaluating clover and medic cultivars at Langgewens in the Swartland and at Tygerhoek in the Rûens, it appears that the subterranean clovers may not be suited to areas in which soil moisture remains high in summer. The good summer rains at George and in the Langkloof resulted in premature germination of the sub-clover seed and this seriously affected regeneration in the growing season and may result in the termination of the trials in these areas.

The *Medicago* species have a greater proportion of hard seeds in summer and therefore do not suffer the same consequences. It appears also that the establishment of annual legumes in the Langkloof area will present problems, largely because of the extremely low temperatures which accompany moist conditions and possibly because of soil fertility problems as well.

Jemalong and Cyprus varieties of *Medicago truncatula* and Harbinger medic did well in all localities and are therefore the most likely plants for successful establishment in areas with uncertain potentials for dryland pasture. The Clare variety of subterranean clover gave excellent yields (5,9 tons per ha at Riviersonderend) in areas with an extended growing season and responds well to early rains.

The ultimate value of the annual legumes in the Winter Rainfall Region lies in their ability to supply dry matter and protein for summer consumption. The highest hay yielders were not always those that yielded the greatest amount of pods, burrs or flowers: In general the highest yields of reproductive matter were measured on the medic plots (2,7 tons of Cyprus pods at Heidelberg) and the lowest yields on the Rose clover (*T. hirtum*) plots.

LUPINS

In May 1974 notice was received that the cultivars Stevens, Jak and Steb had been registered in West Germany for the protection of plant breeders' rights and for inclusion in the West German variety list, and consequently on the EEG variety list.

The lupin exporters appointed a local firm to undertake the multiplication of breeders' seed to basic seed. It is the duty of the Field Crop Section of the Winter Rainfall Region to see to the maintenance of breeders' seed; it supplied 39 x 50 kg units of Stevens breeders' seed to this firm.

It was recommended that the Division of Plant and Seed Control should include only the following lupin cultivars in the S.A. variety list: Kubesa, Jak, Stevens, Steb, Rommel, Borre, Ligvoet, S.E. Yellow and Pfluges Gela.

Thirty herbicides were evaluated for use in lupins. The most promising were simazine and atrazine applied before emergence, and pronamide, applied either before or after emergence. No residual activity of these treatments was noted during the following season.

Powdery mildew of lupins caused an epidemic during the 1973 season. Although the fungus which causes the disease has occurred in the Republic for a long time, apparently mainly in glasshouses, this is the first time that it has been so severe and has caused the loss of virtually all the seed produced.

The identification of the fungus as an *Oidium* species has been provisionally accepted. Overseas the disease is attributed to the fungus *Erysiphe polygoni*, the sexual stage of the powdery mildew fungus.

It is not yet possible to explain the sudden appearance of the disease, but it may be dependent on weather conditions.

There are indications that sulphur may be effective against the disease and may possibly be the most economic preparation against it.

ERAGROSTIS CURVULA

As a result of the increased red meat prices there has been a considerable increase in interest in *Eragrostis curvula* in the Highveld Region, particularly in the eastern parts of the region. In the Harrismith district a survey revealed that 30 per cent of the farmers had recently increased the area under this crop on their farms.

There was a moderate increase in the area under *Eragrostis curvula*, particularly in the drier parts of the Eastern Cape Region. In the Aliwal North district the aim is to establish a perennial forage crop on 40 per cent of the dryland. Here weeping lovegrass has proved itself during the year under review as a forage crop which can help cut the cost of mechanisation and bring more stability to farming.

In the Barkly East district *Eragrostis curvula* has shown that it can be used to very good effect for the stabilisation of waterways.

The *Eragrostis curvula* breeding programme at Cedara has resulted in the evolution of two new cultivars, Rietspruit and Umgeni (not yet released). Rietspruit is a blue *robusta* with a very high yielding ability and an extremely rapid hay drying rate and Umgeni a *curvula* or weeping type offering high herbage yields, prolific seed production and greater resistance to root knot nematode (*Meloidogyne javanica*) than the Ermelo type.

Large scale seed multiplication of these cultivars has been started.

Fertilisation trials conducted on hay pastures receiving 0, 10 tons and 30 tons of hay per hectare had been fed back to livestock during the winter months demonstrated that the implementation of this "feedback" practice could improve the response to added fertiliser considerably.

This response was especially marked at lower rates of fertilisation: where no fertiliser was applied the effective yields were 0,6 tons per ha, 2,4 tons per ha and 7,0 tons per ha where 0, 10 tons and 30 tons of hay had been fed back. With the application of 200 kg of nitrogen with phosphorus and potassium, as is generally recommended for the Eastern Highveld, the corresponding yields were 8,5 tons per ha, 10,0 tons per ha and 11,5 tons per ha respectively.

With respect to seed production it was found that seed fertilisation (as for hay production) of 100 kg of nitrogen per ha in spring more than doubled the seed yield, raising it from 100 kg to 200 kg of seed per ha. This was also true of spring burning. The average yield of spring burnt treatments when fertilised with 100 kg of nitrogen was close to 300 kg of seed per ha, whereas treatments which had been mown in spring yielded approximately 110 kg of seed per ha.

BUFFALO GRASS

Owing to its potential, buffalo grass *Cenchrus ciliaris* has become the standard pasture crop of the Ngobok Flats and the Northern Transvaal. But the sensitivity of this grass to aluminium toxicity means that it does not thrive on the sour, sandy soils of the Verberg area.

Research at the Towoomba Research Station again confirmed the high potential of buffalo grass. A further 100 ha of buffalo grass was established during the past summer, which brings the total area planted for research purposes to 200 ha.

There is a great deal of interest in the planting of buffalo grass in the Free State Region as well. Some farmers have planted up to 800 ha.

WOOL GRASS

The preliminary results of investigations indicate that wool grass *Antheophora pubescens* has great promise as a grazing crop in the dry, sandy parts of the Vryburg and Mafeking districts. Although the grass cannot produce as much hay as buffalo grass does, it has great possibilities for radical veld improvement in orthoak-infested veld.

NILE GRASS

Yields ranging from 6,63 to 10,16 metric tons of dry matter per ha were obtained from 25 strains of Nile grass evaluated at Cedara during 1973/74. For the first time, small scale field plantings of Nile grass seed were undertaken. Satisfactory seedbed establishment resulted from autumn sowing at a rate of 10 to 15 kg per ha, in rows 25 cm apart.

Experiments to locate the most compatible single cross combinations for seed production purposes have revealed that strains which form negligible quantities of seed when grown in isolation (approximately 1 per cent seed set) produce fifty times more seed when crossed.

ITALIAN RYEGRASS

The superiority of the Cedara bred Italian ryegrass cultivar, Midmar, was again confirmed in an experiment conducted in the Natal mist belt area. An intensive seed multiplication programme, which will ensure that an adequate quantity of parent seed is available for certified seed production purposes, was started.

A large number of tetraploid plants have been recovered following treatment of diploid Midmar Italian ryegrass seed with the alkaloid colchicine. Preliminary assessments of the polycross progeny suggested that a tetraploid form of Midmar will offer distinct advantages over the diploid form as well as imported tetraploid cultivars.

RHODES GRASS

There was a fair increase in the use of Rhodes grass *Chloris gayana* to improve or replace the natural grazing, particularly in the coastal areas of the Eastern Cape Region. This grass also appeared to be well-adapted in mixtures with perennial legumes and the use of Rhodes grass is expected to increase considerably.

COCKSFOOT

Very promising results have been obtained from two synthetic strains of Cocksfoot *Dactylis glomerata* bred at Cedara for adaptability to local conditions. Their performance was significantly superior to the commercially available imported cultivars.

ITALIAN MILLET

The Transvaal Region's share in the development programme for Italian millet species for use as cereal crops was delegated to the Towoomba Research Station. A research programme was tackled in stages, the first stage being launched during the year under review.



A good stand of buffel grass *Cenchrus ciliaris* at the Omatjenne Research Station in South West Africa

In all, 170 strains and cultivars, 62 of which are indigenous to Southern Africa, were obtained and planted for seed multiplication and preliminary evaluation. Several undesirable agronomic characteristics, particularly in the so-called indigenous lines, will require the attention of plant breeders before farmers will be able to utilise the potential of these lines.

SILAGE CROPS

Thirteen different summer silage crops were compared on the Outeniqua Experimental Farm. The

crops were harvested at the soft dough stage. Within a month of planting signs of a zinc deficiency were observed in most crops. The exceptions were red Italian millet, Japanese millet and Cow Candy, which showed no visual symptoms. At the end of November the crops were all sprayed with a zinc solution, which only provides partial control of the deficiency.

The entries which yielded best were haakdoring sweet sorghum with 41,5 tons per ha and babala, Cow Candy and Haygrazer with 37,9, 36,4 and 33,5 tons per ha respectively.

5. Horticulture

DECIDUOUS FRUIT

WINTER RAINFALL REGION

Climatic conditions in the production areas were generally more favourable than in the previous year; consequently production of most types of fruit was slightly better, although still below normal. It was possible to export a slightly greater tonnage, except for pears, of which a considerably smaller quantity was produced than last year.

The production of most dried fruit was normal, except pears and peaches, and the production of Manapoot raisins and sultanas was hard hit by floods along the Orange River.

Disease-free grafting material

Eleven nurserymen participated in the scheme for the best plant material available. The Fruit and Fruit Technology Research Institute selected parent trees from 17 cultivars from which budwood and cuttings could be taken in collaboration with the Division of Plant and Seed Control in the Western Cape.

A total of 134 clones from 13 different cultivars of apples, pears, plums and apricots were selected over three seasons. Trees from these are being planted this year in order to find the best clone from each cultivar which can be used as parent stock by the Plant Improvement Committee after virus purification.

Apples

At present 33 imported apple cultivars are being evaluated together with 16 local selections. These include a few promising types such as Wellspur Delicious and Golden Delicious — types which may be less susceptible to russetting.

Rootstocks — Very promising results are being obtained with the semi-dwarfing rootstocks MM106 and M7. It appears that with MM106 the production per cm of stem girth was consistently the highest of all the rootstocks evaluated and therefore also higher than Merton 793, the present standard rootstock. M7, though not so heavy a producer as MM106, is important particularly because of its dwarfing properties.

The influence of the rootstock on the incidence of bitter pit is very important in the case of Golden Delicious. The intensity of bitter pit on various

rootstocks compared as follows (from low to high): M7-11, MM109-15, MM106-16, Merton 793-22, M2-23, MM111-25, MM104-38. The influence on tree size (from small to large) was as follows with Golden Delicious and Granny Smith: M7, MM111, MM106, M2, Merton 793, MM109 and MM104.

Planting systems — A planting of Granny Smith and Golden Delicious on the Elgin Experimental Farm, where the training systems palmet, pyramid and vase are being compared, shows once again that the training system as such has no noteworthy effect on the yield. For the first time widely spaced trees gave nearly the same crop per hectare as closely planted trees.

Lighting is becoming a noticeable problem with densely planted trees in that a sharp drop in crop is now occurring with densely planted trees. In 1973, for example, the 3,7 m x 1,8 m (12 ft x 6 ft) palmet of Golden Delicious produced 90 tons per ha, as against only 41 tons in 1974. Since 1973, closely spaced trees have been bearing a greater percentage of fruit on the higher parts of the trees than the widely spaced trees and the fruit on the lower parts of the planted trees is smaller than fruit in the same position on trees more widely spaced.

So far 3,7 m x 1,8 m has given the greatest total crop, but it is now becoming clear that in the long run this planting distance is too small for Golden Delicious as well as for Granny Smith apple trees on Merton 793 rootstocks.

Because European markets insist on a greenish colour for golden Delicious apples the effect of spraying with magnesium and nitrogen, separately and together, on colour was investigated. The treatment where magnesium and nitrogen were applied together gave the best colour. The effect of magnesium alone was also favourable.

Fusicladium — During several experiments it was found that ascospores of *Venturia inaequalis* already begin to germinate as soon as the spore source (infected fallen leaves) is watered. Apple scab infections occurred at a temperature range from 5°C to 30°C.

Storage fusicladium — During the year under review storage fusicladium again occurred to a large extent among Granny Smith apples from the Langkloof. It was found that ineffective control of this disease during the spring, combined with the large number of infection periods since January, was responsible for the rapid build-up potential of the disease. The result was

that Granny Smith apples, particularly those which became infected just before harvesting, later developed storage fuscladium.

In cases where such infected apples were dipped in fungicides such as benomyl or thiophenate-methyl just before packing and were then passed over brushes, storage fuscladium occurred to a far lesser extent.

Low and ultra low volume spraying techniques — In two semi-commercial trials different spray volumes and dosages of the fungicides thiphenate-methyl and benomyl, respectively, were applied for the control of apple mildew (*Podosphaera leucotricha*) and apple scab (*Venturia inaequalis*). Low and ultra low volume (ULV) quantities of 80 and 30 litres per ha, respectively, were applied with a prototype spraying machine developed by

the Fruit and Fruit Technology Research Institute. The abovementioned sprayings were also compared with conventional high-volume sprayings of roughly 3 600 litres per ha.

The results show the following:

1. There is no significant difference in the control of both diseases where 30 litres, 80 litres or 3 600 litres per ha are applied.
2. As regards the use of ULV on apple mildew dosage reduction of up to a quarter, and in the case of fuscladium of up to a half, of the quantity conventionally applied gave the same degree of disease control.



Preliminary investigations indicate the occurrence of the disease known as apple proliferation in Golden Delicious and Cox's Orange Pippin orchards in the Elgin area. The twig on the left shows the characteristic untimely development of axil eyes and inflorescences. Infected trees bear smaller fruit than normal trees. Due to the micoplasmic nature of the disease and its consequent sensitivity to high temperatures it is possible that it will not affect yield and quality as much here as it does in Europe



These pears were all picked at the same time, but those from the wooden box (left) are ripe after cold storing, while those from the carton (right) are still green and still have a long shelf-life

Residue analyses with fenthion showed that the residue from low and ultra low volume applications can be from 4 to 8 times higher than with high volume applications. This discovery is of great importance because the safety period between spraying and harvesting of fruit will require special attention when the ultra low volume technique is used.

The increased degree of control with the smaller spray volumes is ascribed to smaller drop sizes which result in a better cover of plant surfaces and thus a higher residue.

Codling moth control — The control of codling moth in apples and pears is still very important since measures against this pest are very closely related to the control of other pests.

Phase one in the development of a sex trap monitor system in the control of the codling moth *Carpocapsa pomonella* has been completed. The findings of the greatest immediate importance are the following:

Codling moth activity, which may last for eight months in one season, begins earlier and ends later than was previously thought.

There are significant sources of infestation outside orchards.

Great infestation potentials exist in some orchards, requiring an intensification of spraying programmes.

4. There are also many orchards with very low infestation potentials where control costs can be drastically reduced or even eliminated for a season or longer.
5. There is a clear correlation between codling moth activity, as indicated by the traps, and actual infestation of the fruit, as well as between moth activity and the size of the monitor area of the traps.

On the strength of these discoveries it is now possible to launch phase two.

Superficial scald control — Techniques for the application of diphenylamine (DPA) for the control of superficial scald have been further refined and growers can now achieve excellent scald control in apples stored and handled in bulk. DPA is applied either by dipping or drenching. Methods to ensure maintenance of the correct concentration have been developed and tested in co-operation with growers.

Colour of Golden Delicious for export — To ensure that cold-stored European Golden Delicious apples are not passed on to the consumer as freshly imported apples, consumers in European countries now no longer demand "golden" Golden Delicious but green ones. Standards recommended by the Fruit and Food Technology Research Institute were applied in the 1974 season and did satisfy the markets in Europe. Growers, however, claim that apples picked at this stage of maturity do not have as good dessert and keeping qualities as fruit picked at a somewhat more mature

stage. In addition, picking at the early stage results in an overall loss of mass which is estimated at about 10 per cent.

For the 1975 season a slightly more mature picking stage will probably be decided upon, and the industry will make extensive use of data in this connection obtained by the FFTRI over the past five years.

Preliminary investigations already point to the occurrence of apple proliferation in local Golden Delicious and Cox's Orange Pippin orchards in the Elgin area. Owing to its mycoplasmic nature and resultant sensitivity to high temperatures, this disease should not have the same detrimental effect on crop and quality under local conditions as in European countries. It can, nevertheless, impair fruit size in cool years.

Pears

Seven imported cultivars and four local selections have now been planted out for final evaluation. An early Bon Chrétien, known as type E, ripened about 10 days before the ordinary Bon Chrétien and produced roughly 75 per cent more than the ordinary Bon Chrétien up to the ninth leaf. Indications are, however, that with this selection there is back-mutation of as much as 20 per cent to ordinary Bon Chrétien and it may therefore not be suitable for commercial release.

Rootstocks — Two rootstock clones, viz BP1 and BP2, were handed over to the Plant Improvement Committee for multiplication for commercial release at a

later stage. The former is a dwarfed rootstock, whilst the latter produces a tree just as big as a seedling rootstock does, but its trees are much more productive.

Fruitset — The investigation of poor fruitset in Packham's Triumph, the most popular dessert cultivar, showed that defective cross-pollination is not a serious limiting factor. An investigation of the soil and root conditions on 14 farms indicated that the presence of permanent cover crops and poor aeration of the soil during flowering and fruitset may possibly play a very important role.

During the past season cases were also found where internal decay of Packham's Triumph occurred owing to excessively high nitrogen dressings in the spring.

Codling moth control — The sex trap findings already discussed in connection with apples also applied to pears.

Owing to the almost total infection of pear selections by vein yellows, reliable tracing of this virus after heat treatment is essential. Under local conditions it was found that the species *Pyronia veitchii*, unlike the standard indicator is capable of tracing light strains of the vein yellows virus.

This is very important in view of the recent overseas discovery that light strains of the vein yellows virus can significantly reduce the production of Conference, Comice, Beurre Hardy and Bon Chrétien.



The prototype of the ultra-low volume spraying machine developed by the Fruit and Fruit Technology Research Institute

Pear cartons — The bulk of South African pears exported in polyethylene bags in non-ventilated tons. Excessive gas injury in Beurre Hardy pears during the 1972/73 season cast suspicion on this pack. The overall benefits of this pack, including excellent financial returns, are such that its use must be continued until the problems solved as soon as possible. A concerted research programme was accordingly followed during the 1973/74 season and many treatments tested.

Ethylene was removed by including potassium permanganate soaked vermiculite in the pack. Carbon dioxide was removed either by including packets of dry ice in the pack or by perforating the polyethylene bag. The most promising results were obtained in the packs which had 100 pinhole perforations applied to the bags.

This modified pack could also result in less stringent transport requirements for the transport of Beurre Hardy and Beurre Hardy pears from the farm to the harbour. It will also be safer for use on the South African markets.

ches

At present 31 cultivars which were recently imported from overseas are being evaluated on experimental farms, together with 58 local selections. No canning selections look very promising.

The indications are that fruit size during thinning plays a more important role in determining the eventual fruit size than the quantity of fruit per individual shoot or shoots. This means that a specific branch can be thinned more heavily than usual, provided the fruit left behind after thinning is all of a good size. The total number of fruit per tree must not exceed a certain maximum, however.

Trial plantings on intensive systems (5 m x 4 m) coupled with summer pruning yielded 20 tons per ha in the fourth year as against 5 tons per ha from a 6 m x 6 m planting which is normally pruned in winter.

It appears that the chief advantage of summer pruning is that it results in better lighting and dwarfs the trees.

Die-back complex — During an investigation of the die-back in peach trees in the Western Province, the fungus pathogens *Phytophthora crytogea* and *Phytophthora drecksleri* were isolated from trees that were dying back. The former fungus was described previously as a pathogen for peach trees in Californian conditions. It was also established that the hair roots of peach trees were also affected by pathogens such as *Phytophthora irregularis* and *P. vexans*. This is the first time that the occurrence of these pathogens in South Africa has been reported.

Wound dressings — Several woodrot fungi, such as Basidiomycetes (*Stereum purpureum*, *Polyporus hirsutus* and *Schizophyllum commune*) and the Ascomycetes (*Eutypa armeniaca*), are responsible for the short life of drupes, particularly peaches and apricots. As potential new wound dressings, combinations of certain basic chemicals with a mixture of the fungicides captan, 8-hydroxyquinoline and pyra-carbolid gave excellent control of Basidiomycetes as well as Ascomycetes, and also a good wound cover.

The pollen-borne peach rot diseases which, as already reported, causes great damage in the peach cultivars Goosen, Keimoes and Kakamas in the Elgin and Somerset West areas has now also been identified at Tulbagh. This disease syndrome has also made its appearance in the Walgant cultivar.

Special efforts are now being made to release rosette-free graft sources to the deciduous fruit multiplication Scheme.

Apricots

A total of 21 imported cultivars are at present being evaluated and six local selections are also being tested at various places. One of the local selections (No. 35/9) is at present regarded as very promising, and its release to the industry is being considered. This is a good bearer which is suitable for canning and dessert, but not for drying.

Dried apricots — The effect of fruit ripeness on the yield and quality of dried apricots was investigated. The yield from the ripe fruit was 20 per cent of the original mass, but the yield from half-ripe fruit was only 18 per cent. The ripe fruit also showed a considerably better absorption of sulphur dioxide during re-processing. Fruit which was harvested at the stage when it was suitable for eating was superior to half-ripe fruit in every respect.

The quality of dried apricots from both ripe and half-ripe fruit deteriorated when dried to a moisture content of less than 18 per cent, however.

Plums and prunes

The search for cultivars resistant to bacterial spot *Zanthomonas pruni* remains one of the chief aims in breeding and selection. At present 17 imported cultivars are being evaluated at various places together with 27 selections from the FFTRI breeding programme.

During canning trials with Sungold, the plum cultivar released by the FFTRI in 1972, it was found that for commercial processing this fruit should preferably be peeled with hot caustic soda. Peeled samples which were canned both as whole fruit (with the pip) and as halves were very tasty.

Harvesting of prunes — In practice prunes are harvested as much as six times in the same season, and production costs can be cut considerably if the number of harvests is reduced. Trials were conducted with 2-chloro-ethyl-phosphonic acid (Ethrel) which is absorbed by the fruit and metabolised to ethylene, a ripening hormone. The release of ethylene from Ethrel results in an accelerated ripening of fruit which in practice means a shorter ripening period.

By spraying with 200 ppm Ethrel five to seven days before harvesting, 80 to 100 per cent of the crop can be picked in one day. The considerable financial and labour advantages offered by this preparation are arousing great interest among producers.

However, research is also being conducted into the addition of minimal quantities of a morphactin, such as EMD 7031 W, which has synergistic properties and makes it possible to reduce the Ethrel concentration by about a half without impairing the effect on ripening.

Dehydration of prunes — Since the dehydration of fruit has certain advantages over sun drying, the cost of drying prunes with the aid of a small commercial dehydration tunnel was established. This amounted to about 5,2c per kg of dried prunes.

SUMMER RAINFALL REGION

Peaches

The peach breeding programme in the summer rainfall area continues to yield excellent results. During the past season three new peach cultivars were released for cultivation in areas such as the Eastern Free State, where late cold spells are often a problem. These three cultivars flower relatively late so that damage by cold is largely avoided. In addition, they possess very good dessert and/or canning qualities.

Imperani

This is a yellow fleshed clingstone peach with a touch of red round the stone. It flowers from 20 August and ripens during the first week of January. This is a very attractive round peach with a yellow ground-colour and a red blush. It is of a good size and is outstandingly handleable owing to its very firm flesh.

Ficksburg

This is also a yellow-fleshed clingstone which is slightly red around the stone. It flowers from mid-August and ripens early in December. It has a yellow ground-colour with attractive red cheeks. The

tree has very few leaves. It handles and transports excellently.

Clocolan

This is a yellow-fleshed freestone peach which flowers from mid-August and starts ripening early in December. It has a yellow ground-colour with a red blush. It handles and transports well.

Peach rootstocks — The Nemaguard clones 8 and 14 which showed resistance to *Meloidogyne incognita* were also tested for resistance to *M. javanica* during the past season. Clone 14 was very promising in this regard. It was also established that both clones breed true as regards their resistance to *M. incognita*, so that it is not necessary to propagate them vegetatively to retain the resistance.

A number of Okinawa clones showed a high degree of resistance to both *M. incognita* and *M. javanica*.

Diseases — Freckle, *Cladosporium carpophilum*, common in peaches. In January 1974 the canker phase of this disease was observed for the first time in young peach shoots at the Horticultural Research Institute.

Owing to the good summer rains during the past season the late canning cultivars were very badly affected by brown rot *Monilinia fruticola*.

False codling moth — During the past season false codling moth again caused considerable problems in peach orchards. Infestations were as high as 30 per cent in the vicinity of Magaliesberg.

Apricots

There is a very good demand for canning apricots, but there are no noteworthy plantings of this crop in the summer rainfall area. An important reason for this is the lack of really suitable cultivars. Two seedlings which bore for the first time this year were very promising. Canning trials showed that the quality of the can product compares favourably with that of Peekapara and Bulda.

Strawberries

Thanks to the improved cultivars Parfaite and Selekt released by the Department, to the Departmental virus-free strawberry scheme introduced in 1969, and to better cultivation methods, the strawberry yield per hectare was increased four to fivefold.

The importance of strawberry cultivation for the fresh market is evident from the fact that 420 tons were handled on the Pretoria and Johannesburg markets alone.



Apple trees on different rootstocks: the Golden Delicious (left) is grafted on Merton 793, a semi-vigorous rootstock, while the much smaller Golden Delicious (right) is on M VII, a dwarfing rootstock

The higher yields also had the result that for the first time one of the biggest canning factories in the Transvaal received enough strawberries to meet its processing capacity, viz 104 tons.

Trials during the past season showed that strawberries cultivated in tunnels yielded 22 per cent higher than in normal cultivation in the open.

This year more than five hectares of strawberries were cultivated in plastic tunnels. It is now possible for producers to market strawberries on a fairly large scale in June. A yield of 40 tons per hectare was obtained this way during the past season.

The strawberry breeding and selection programme is continuing. A special search is on for good quality strawberries which will ripen even earlier than the present cultivars, and also for better cultivars for cultivation in protective structures.

The Horticultural Research Institute supplied 10 000 Parfaite, 12 000 Selekt, 6 000 Tioga, 2 500 Libelle, 400 Festival, 300 Robyn plants, and 3 000 plants of the 60-140 breeding line to approved nurseries in the Transvaal for breeding under the strawberry plant improvement scheme. The scheme has now been going for four years, but the present nurseries are still unable to meet the demand.

Cherries

Cherry producers in the Eastern Free State suffered heavy losses during the past season as a result of cold damage which reduced the yield by an estimated 40 per cent, though the quality improved owing to the larger fruit. The yield of yellow cherries in particular was severely affected by the cold spell in September.

The trend in establishing new cherry orchards is to plant more yellow cherries. Bacterial canker remains a serious problem particularly because old bearing orchards are infected and are therefore a source of infection. Most producers now follow the recommended spraying programme against the disease, however.

With the introduction of a cherry plant improvement scheme, in which four approved nurseries are now participating, an effort is being made to supply healthier planting material to the industry. The first virus-free propagation material was released to the industry during the winter of 1974.

The first results of propagation studies with rootstocks indicate that certain Mahaleb clones (Mahaleb B40 and Mahaleb B47) are easier to root with hardwood cuttings than the ordinary Mahaleb.

It seems that winter climate and soil temperature have a marked effect on the rooting of hardwood cuttings. It can be provisionally recommended that Mahaleb cuttings be planted out at three times, i.e. in May, June and July.

Up to 45 per cent rooting in hardwood cuttings was obtained with the Stockton Morello rootstock where the base of the cutting was treated with 2 000 ppm indol butyric acid. Good results were obtained by rooting Stockton morello under mist spray and by using softwood cuttings. More than 90 per cent rooting was obtained where the bases of cuttings were treated with 2 000 ppm indol butyric acid.

So far it has been possible to multiply Mazzard F12/1 and Mazzard clones with certainty only by using the time-consuming and round-about heel-in method, but the initial results show that the multiplication of Mazzard by means of softwood cuttings under mist spray justifies investigations using this method.

The initial indications are that the new virus-free Mazzard hybrids (Fb 2/58/48 from East Malling) multiply fairly easily by means of hardwood cuttings. These hybrids will be bred as rapidly as possible for testing in a rootstock trial to establish their rootstock characteristics. If the Mazzard hybrids prove to be good rootstocks, this can mean much to the cherry industry in view of their apparently easy multiplication.

TABLE GRAPES

WINTER RAINFALL REGION

Lack of irrigation water in the Hex River Valley again limited the size of the crop but it was nevertheless possible to market slightly larger quantities than last season.

New cultivars

In all 23 imported cultivars and 40 local selections from crossings from breeding programmes of the Fruit and Fruit Technology Research Institute and the Horticultural Research Institute are being evaluated. Four of the selections that are already in bearing are considered very promising.

Selection programmes to find the best propagation material of eight table grape cultivars, viz Waltham Cross, Barlinka, Queen of the Vineyard, Alphonse Lavallée, Almeria, New Cross, Salba and Golden Hill, are still in progress. Material of the first three cultivars from the preliminary selection has already been made available to producers.

After three years of trials in which the effect of the growth regulant Cycocel on the bearing and growth habit of Waltham Cross grapes was investigated, it was found that sprayings with 250 and 500 ppm 21 days before flowering results in a better berry set but at the same time produces smaller berries. Shoot growth decreased by almost 50 per cent. Because smaller berries are formed, this method of improving berry set cannot be applied.

Trials carried out on the Hex River Valley Experimental Farm with Salt Creek as the rootstock showed that this rootstock thrives very well on sandy, sandy and stony soils. This rootstock is particularly suitable for use where replantings of Jacquez are growing poorly on soil previously used for Jacquez. As a result this trial most new vineyards established on sandy and sandy and stony soils are being established on Salt Creek at present.

The red leaf syndrome

The red discoloration of the leaves of Barlinka grapes during early summer has been increasing in the last few years, especially in the Hex River Valley. Other symptoms are poor growth and reduced production. Surveys and leaf analyses have shown that a low calcium content and poor root growth are correlated with the red leaf syndrome. A similar relatively low magnesium and nitrogen content of the leaves should probably be regarded as a secondary effect of calcium deficiency.

A demonstration trial in the Hex River Valley aimed at confirming these hypotheses has already shown that increased calcium applications through fertilising and spraying caused the red leaf symptoms to disappear. Methods of raising the calcium status of the soil are being investigated at present.

Poor colour in Barlinka grapes

Poor colour in Barlinka grapes is a problem that occurs in the Paarl area in particular and results in producers suffering losses amounting to thousands of rands annually, since the grapes do not meet the colour requirements for export. Spraying trials with the growth regulant Ethephon have shown that this treatment not only greatly improves the colour but also promotes earlier ripening.

This breakthrough could be of great benefit to Barlinka producers in future in that they will be able not only to market more grapes but also to manipulate the harvesting time.

Oidium

Trials were carried out to determine how the fungus *Uncinula necator* survives on grapevines. Fully

ected vines were placed in isolation chambers during the winter and kept there until the end of the growing season. It was found that:

The leaves and shoots of most of the vines got botrytis oidium.

Since no spores could have come from outside it may be assumed that the fungus came from infected buds.

In all probability the pathogen survives as fungus mycelium in the infected buds.

Botrytis rot

Trials were carried out in which pre-harvesting and post-harvesting treatments were applied against botrytis on table grapes. Pre-harvesting treatments consisted of 4 sprayings with the fungicide benomyl, followed by 5 sprayings with benomyl or dichlofluanid. At picking time the grapes were packed in polyethylene bags to which 18 cc of a 12½ per cent sulphur dioxide solution had been added. The results showed the following:

Even if the field potential is high, botrytis rot is reduced by the pre-harvesting treatment and can therefore be very effectively controlled even if the grapes are packed in polyethylene bags.

Sulphur dioxide damage was extremely slight.

This type of treatment also ensured that the stems did not dry out and the berries become soft.

Research on the post-harvesting sterilisation of table grapes against adult vine snout beetles (*Stenus callosus*) is necessary because the sanitary regulations of some countries do not permit the importing of grapes from countries where this pest occurs. Despite intensive trials over the past three years there has been no success so far. All treatments which kill the beetle also cause serious damage to the grapes.

One of the findings was that cold storage at the minimum temperature of -0,5°C for 21 days, the minimum the grapes can tolerate well, has no effect on the beetle. Similarly, methyl bromide and ethylene oxide are effective against the beetles, but only at high concentrations and exposure periods that cause serious damage to the grapes.

Pre-cooling

Work done over a number of years proved that it is inadvisable to start pre-cooling as soon after harvesting as possible. Recently basic studies showed that *Botrytis*

cinerea decay may develop rapidly in susceptible samples if they are held at ambient temperature for 6 hours.

These results have led the table grape industry seriously to consider the building of inland pre-cooling stores. Work done by the Fruit and Fruit Technology Research Institute has established that to be wholly successful inland pre-cooling must be followed up by refrigerated transport until the fruit is delivered to the overseas markets.

Picking maturity of table grapes

The use of a sugar:acid ratio for the determination of the maturity of table grapes does not always give a reliable indication of palatability. Various indices, all incorporating taste panel evaluations, were tested.

The results of three years indicate that there is a universal relationship between sugar content and taste acceptability, irrespective of cultivar, area and harvesting date.

Quality of Waltham Cross grapes

A thorough survey of farms in the Upper Berg River area was undertaken by the Department of Agricultural Technical Services. The survey included soil, climate and all cultural practices. But if such a survey is to be carried to its logical conclusion, the keeping quality of the fruit produced on these plots must also be investigated.

The quality of table grapes harvested from a series of plots on farms in the Upper Berg River area has been determined for two successive seasons. Big differences in quality have been found in the grapes from different plots and the aim is to relate these differences to specific factors, such as soil, farming practices or microclimate.

Heat treatment of the chief table grape cultivars, including Almeria, Alphonse Lavallée, Barlinka, New Cross, Salba, Queen of the Vineyard and Waltham Cross, was continued and another 40 subclones were propagated. Established subclones of these cultivars are being indexed this season.

The necessity for virus purification of table grape clone selections is underlined by finding that stem-pitting can reduce the production of quality grapes of the sensitive cultivar Queen of the Vineyard significantly (by 26 per cent), even during the first four production seasons.

SUMMER RAINFALL REGION

Downy mildew *Plasmopara viticola* was found on grapes in the Transvaal for the first time this year. The disease caused serious damage, especially in the Groblersdal and Pretoria areas. Vineyards in these areas were virtually completely defoliated, young growth was killed and the quality of the grapes, especially grapes of the late cultivars, seriously impaired.

It is clear that the disease was greatly aggravated by the wet, cool conditions experienced in these areas during the early part of the summer. It should be generally accepted that the disease might occur here every year in future. Producers are therefore seriously advised to follow a preventive spraying programme against downy mildew every year.

It should be emphasised that control measures against the disease have to be started during spring, i.e. before any symptoms appear on the grapes. If one waits until symptoms appear it is virtually impossible under summer rainfall conditions either to control the disease or to prevent damage.

The control programme for the disease is exactly the same as the programmes recommended by the Horticultural Research Institute for the control of oidium and anthracnose, except that the spraying programme should be started about three weeks earlier than in the case of the other two diseases.

If not, wet conditions do not occur during the early summer, the normal control programme for oidium and anthracnose should provide sufficient control of downy mildew as well.

Owing to the rainy conditions during early summer, widespread outbreaks of anthracnose also occurred, especially on sensitive cultivars such as Alphonse Lavallée and Hanepoot. In Groblersdal there were certain Alphonse Lavallée vineyards where the bunches were largely destroyed by anthracnose. It is therefore clear that if producers are to make a success of table grape production in the Transvaal they will have to apply the necessary control measures against these diseases.

Owing to the shortage of grafted Pirobella vine and the exceptionally keen demand for this early black grape many farmers are compelled to plant ungrafted vines. This cultivar has again proved to be very resistant to cracking. Because of the high rainfall in the summer rainfall area Pirobella was the only early cultivar that could be marketed with little difficulty.

The demand for the two new early white cultivars, Jacaranda and Golden City, which were released by the Department in 1972, was so good that all the available material was bought by nurserymen.

Breeding

Because the summer was very wet it was possible to determine which selections and cultivars are resistant to berry cracking.

The selections BS/BL3 and HD/Q/HD67/627 not only had this quality but were also impressive with regard to appearance and bearing.

BS/BL3 bears medium large black, well-filled bunches. Furthermore very few small berries are found. The berries are medium-sized (7,6 g) and oval; the bunches ripen in the middle of February. The selection also performed well at Uppington.

Selection HD/Q/HD67/627 is a fertile Hanepoot grape that does not shatter at all and ripens a month before Hanepoot, i.e. in the middle of January. The vines also grow more vigorously than Hanepoot.

A very promising early black grape that looks a great deal like Barlinka performed well again this year. This selection is Q/BL69-699, a seedling from the crossing Queen of the Vineyard x Barlinka. It ripens early in January. The berries are as large as those of Barlinka, but colour far better; the berry attachment is like that of Barlinka. The bunches do not appear to be so dense. The ability of the selection to stand up to storage and transportation will be determined with a view to exporting.

The Bien Donné selection 17/19 was also far more promising as an early white grape. The grape ripens together with Queen of the Vineyard. The bunches were well filled with virtually no small berries. The berries were medium-sized (5,9 g), resistant to cracking, and had a slight muscat flavour.

Resistance to rot and cracking

A survey of selections and cultivars showed that nine selections and the cultivars Pirobella, Margaret and Mario Pirovano were very resistant to berry cracking. Since Keuka is the communal parent of most of these selections it appears that this cultivar carries the genes for resistance to berry cracking.

Virus purification of table grapes

Two new methods were developed by means of which heat therapy and tissue culture are used in combination for the virus purification of grape material. About 123 plants grown from cultures by this method are now ready for virus indexing. This includes cultivars or breeding strains such as Pirobella, Muska, Golden City, HB6/28, QK44 and QK46.

Three vines of the cultivar Pirobella and two Orange River vines were given the 128 days of heat treatment required for virus purification. These vines can now be indexed for viruses.

WINE GRAPES

In the viticultural areas of the Western Cape the summer season has been the driest since the beginning of the century. It was preceded by an exceptionally dry winter, the average rainfall being 669 mm, as against the long-term average of 669 mm.

While the Western Cape was experiencing drought, the crops suffered serious flood damage in the Lower Orange River area. Largely because of these unfavourable climatic conditions, the total grape harvest during the years 1971 to 1973 was extremely disappointing; the harvest remained more or less constant despite the large plantings of new vineyards in the past few years.

Despite the smaller harvests, the quality of red wines was generally excellent and 1973/74 may be considered an outstanding year for red wine. The quality of white wines, on the other hand, cannot be described as more than satisfactory.

The domestic marketing prospects for virtually all types of wine remain promising. The consumption of red wines in the middle and high price ranges is still rising dramatically. There has also been a considerable revival in the domestic sales of brandy and fortified wines and a sharp increase in the consumption of wine spirits. These factors made it necessary to introduce rationing for both drinking and good wine.

The total wine crop has increased by 37,41 per cent since 1964. The established viticultural areas made a relatively small contribution to this increase in production; the new areas have been responsible for more than half the total crop increase since 1964. The expansion of the wine industry to production areas such as the Orange River Area, the Northern Cape and the Orange Free State is making increasing demands on the research and extension services of the Department.

The certification system for area, vintage and cultivar wines finally became established during the year under review. The application of this system has far-reaching implications for the South African wine industry and will bring it up to the standard of the chief wine-producing countries of the world, particularly from the point of view of marketing. All sectors of the South African wine industry have now accepted the system and good progress has been made with its practical application.

A review of the activities of the Institute over the past year shows that a very broad field of research was covered. The evaluation of wine grape varieties better adapted to the South African wine industry is still receiving a great deal of attention and the release of four promising new white varieties and one red variety will be recommended in the course of the coming season.

Good progress was also made with the elimination of poor establishment methods — one of the most troublesome problems under dryland conditions. Another finding of great economic significance is the evidence that unit production can be raised by 50 per cent or more by the judicious choice of planting distances and trellising systems, without any loss of wine quality. This applies even to a quality variety such as Cabernet Sauvignon.

In the course of its wine chemistry research the Institute recently made an international breakthrough when it succeeded in isolating and identifying the characteristic aroma substances of certain late harvest wines. This brings us another step closer to a more objective method of judging wine quality.

The application of the system of area, vintage and cultivar wines will mean that in future the Institute's research programmes will have to be far more area-orientated. The necessary adjustments have already been made. For instance, particular emphasis is placed on systematic soil and climate studies of smaller, fairly homogeneous soil and climatic areas. These are supplemented with cultivar adaptation studies and the investigation of effective cultural techniques in the various subareas. The increasing scarcity of the resources of labour and water has led the Institute to make greater provision in its future research programme for research on mechanisation and irrigation.

Evaluation of imported cultivars

Released scion cultivars

During the past few years the Department released two white wine cultivars, Gewürztraminer and Sylvaner (clone Beier), and two red wine cultivars, Cabernet Sauvignon (clone Davis) and Pinot noir (clone B.K.-5), for commercial cultivation. These four cultivars were placed on the official list of good wine cultivars on the basis of their performance in cultivar trials at Nietvoorbij and their excellent wine quality. The available propagation material was declared free of harmful viruses and arrangements were made to multiply the material at the K.W.V.'s multiplication farm at Robertson as soon as possible and establish it in experimental blocks belonging to producers.

The imported white wine cultivars Bukettraube (7/4), Weisser Riesling (7/5) and Neuzucht Kerner

(13/2) have been undergoing evaluation for seven seasons; all of them, but particularly Bukettraube, appear to be very valuable wine grape cultivars. These cultivars are already being multiplied in co-operative experimental blocks.

Scion cultivars in open quarantine

Since 1967 about 125 scion cultivars, clones and crossings have been established in open quarantine at the Institute's experimental plots for evaluation.

Certain cultivars have already been selected and are now undergoing evaluation on a larger scale. These include the red wine cultivars Heroldrebe (14/1) and Sämling 3130 (11/1 ex Weinsberg), which are now in their fifth leaf, the white wine cultivars (11 - 54 Gm, 3 - 48 Gm and Reichensteiner 18 - 92) which are in their fourth leaf, Burger, Flora, Emerald Riesling and Gewürztraminer, which are in their third leaf, and Sauvatio in its second leaf.

The following cultivars will be multiplied for further evaluation on the grounds of the quality of their wine: Weisser Riesling (clone 239), Rüländer (clone H1), 22-73 Gm, 3-46 Gm, Chenin blanc, Vital, Azal branco, Manseng supérieur, Terret blanc and Rieslander. The first four of these cultivars are particularly promising.

The fifteen wine grape cultivars and crossings, four sultana cultivars and clones and one Zante currant cultivar established on their own roots at Lutzville in 1971, have done well. During the past season another 13 cultivars, clones and crossings were added to the planting and three new cultivars were established on Jacquez at Nietvoorbij.

Clone selection of scion varieties

Attention has long been given to clone selection in an attempt to improve the performance of certain commercial cultivars. Forty-nine clones of the following six cultivars are at present being evaluated: Caberne



Vine canes soaked for different periods in different concentrations of the fungicides Captan and Chinosol and then inspected for fungal growths 20 days later: upper left, in 0,5 per cent Chinosol for 2 hours; upper right, in 0,25 per cent Chinosol for 3 hours; below left, 1 per cent Captan for 4 hours; below right, no treatment

on (14 clones), Shiraz (6), Steen (17),
ard (6), Hanepoot (5) and Cabernet franc (1).
st phase evaluation has now progressed so far that
most promising clones were multiplied last season
nd phase evaluation.

With a view to virus purification, clone selections
following cultivars have already received heat
ent at the virus unit at the Plant Protection
ch Institute at Stellenbosch: Three Steen and
age (black) clones, two Hanepoot and Clairette
e clones and one clone of each of the following
s: Colombard, Grenache noir, White Hermitage,
, Pinotage, Riesling, St Emilion and Green Grape.

Collection of wine grape cultivars Nietvoorbij

The following well-known white wine cultivars
ed 5 kg or more per vine at 20^oB (about 10 tons
) on R99: Steen — 10, Clairette blanche — 9,
bard — 9, French — 9, Clairette Egrenouse — 9,
Muscadel — 9, Kanaan — 9, White Grape and
— 8, Keuka — 8, Green Grape — 7, St Emilion — 6,
blanc — 6 and Ferdinand de Lesseps — 6.

The production of the following well-known red
cultivars was 3 kg or more per vine at 20^oB (about
s per ha) on R99: Red Steen — 12, Alicante
net — 10, Carignon — 8, Pinotage — 8, Hermitage
infandel — 8, Baroccas — 8, Cabernet franc — 7,
che — 7, Shiraz — 4 and Pontac — 3. Cabernet
non and Pinot noir produced 2,4 and 0,7 kg per
respectively. Cabernet Sauvignon produced just over
per vine on 3306 and Jacquez, and Pinot noir
ced 4 kg per vine on Rupestris du Lot and 143B.

Production of scion cultivars on a commercial scale at Nietvoorbij

The white wine cultivars which did well this year
old trellises were Bukettraube, with a yield of
per vine at 20^oB, Green Grape with 5,1 kg,
on with 4,9 kg, Sauvignon blanc with 4,8 kg,
poot with 3,7 kg, Kerner with 2,8 kg and
onnay with 1,8 kg.

Evaluation of cultivars at Robertson

The following white wine cultivars yielded best
(the figures indicate production per vine on Perold
es at 20^oB): Bukettraube — 14 kg, White Muscadel
kg, Clairette Egrenouse — 13 kg, French — 12 kg,
poot — 12 kg, Clairette blanche — 12 kg, Raisin
— 11 kg, St Emilion — 11 kg, Colombard — 11 kg
urztraminer — 10 kg, White Hermitage — 10 kg and
e Grape ex Steen — 9 kg, as against 8 kg from Steen
r the same conditions.

Cultivar trial on silt at Lutzville

Crop data were collected for the first time in
1974, from 21 cultivars, each on four rootstocks.

Apparently with most varieties the production per
hectare is considerably lower when they are grafted onto
Rupestris du Lot than when the other three rootstocks
of the trial are used. No rootstock constantly yielded the
highest production. Richter 99, 101–14, Jacquez and
Rupestris du Lot produced average yields of over 20
metric tons per ha in the case of 13, 11, 10 and 5 scion
cultivars respectively.

The best average productions were obtained with
the following cultivars (production indicated in brackets
in metric tons per ha, at 20^o Balling): Red Steen (31,3),
Grenache (28,2), Carignon (28,0), Crossing 2 (Steen x St
Emilion) (27,7), White Hermitage (Albatross) (22,8),
French (22,8), Raisin blanc (22,5), Steen (21,0), St
Emilion (21,0), Souvenir de Pulliat (20,7) and Pinotage
(20,2).

Only Steen and Müller-Thurgau grapes showed any
significant degree of botrytis.

Evaluation of well-known local rootstocks

During the year under review three rootstock
trials, all with Steen as the scion, were concluded. The
five rootstocks that yielded best at Wellington may be
placed in the following order, from the best to the
poorest: Richter 99, 101–14, 3306, 143–B and 333.
However, there are no really significant differences
between these rootstocks.

The five rootstocks used in the trial at Nietvoorbij
can be placed in the following order, from the best to
the poorest: Richter 110, Richter 99, 143-B, 3306 and
420-A. Here again there were no significant differences
between the rootstocks.

Evaluation of locally bred scions and rootstocks

The locally bred scion crossings (white wine) K1,
K2, K22 and K33 yielded particularly well at Robertson,
producing, respectively, 11,1, 12,9, 8,2 and 10,2 kg per
vine at 20^oB. The production potential of these
crossings is more or less the same; the better yields of K2
and K1 may be ascribed to better resistance to rot. K1 is
now being considered for placement on the official list
of good wine cultivars.

Grafting and nursery practices

Since a great many problems are experienced with
fungus infection in nurseries, two preparations, Captan
and Chinosol, were tested for their efficacy in
disinfecting unrooted grafting material.

The following fungus species were identified on the untreated controls: *Cladosporium*, *Penicillium*, *Aspergillus*, *Stemphylium*, *Rhizopus*, *Alternaria*, *Coniothecium*, *Botrytis*, *Trichothecium*, *Dendrodochium* and a number of unidentified fungi and bacteria. This complex of fungi and bacteria contributes to the rotting of the callus tissue, with the result that a weak graft union is obtained.

Chinosol was found to provide excellent control of fungus infection, but Captan produced very disappointing results. However, Chinosol was unable to control bacteria, even at the highest concentration.

Establishment methods

Moisture conservation with the aid of plastic sheeting during the establishment of vines

The growth and development of vines planted in 1972 under dryland conditions, in the course of an establishment trial with and without plastic soil covers, were determined during the second growing season.

Very favourable root development took place under the plastic soil cover during the first year. At a depth of 0 cm to 20 cm the average root mass under plastic was 6,3 times greater than with clean cultivation, and it was 2,5 times greater at a depth of 20 to 40 cm. The root mass of vines under plastic soil covers was three times as great as that of vines in the clean cultivation treatment. This may be ascribed to favourable soil moisture and soil temperature conditions under the plastic cover.

During their second growing season the vines maintained the vigorous growth of the first year after planting, despite the fact that the plastic sheeting has weathered away almost completely. In October and November the shoots of the vines in the plastic cover treatment grew twice as much in length as those of the vines in the clean cultivation treatment.

Available results and practical experience indicate that the use of a black plastic cover during the establishment of vines under dryland conditions and on the heavier soil types (provided that conditions do not become too wet) can be recommended.

Soil and nutrition studies

Soil preparation

The soil preparation trials at Nietvoorbij (Clovelly form) and Robertson (Shortlands form), in which the effect of trenching depth, addition of organic matter and type of tillage implement are being investigated, are at present in their sixth season of observation.

Trenching depth — As in previous trials, no significant differences with regard to shoot mass data were found between trenching depths of 75 cm and 120 cm. However, there were indications in the Nietvoorbij trial that the 120 cm trenching depth resulted in a better yield.

As in 1972/73, the Robertson trial showed that deeper trenching produced a highly significant increase in the acid content of the must.

Applications of organic matter — The results again show that the addition of as much as 80 m³ of compost per ha and 1 750 bales of straw per ha had no significant effect on yield or shoot growth at either Robertson or Nietvoorbij.

Type of implement — The tendencies observed at Nietvoorbij during previous seasons with shallow ploughing, subsoiling and trenching treatments were again confirmed. The crop and shoot yield per individual vine did not differ significantly in the various treatments and there was no difference in the quality of the must produced by the various treatments either.

Soil cultivation — According to the preliminary results of the soil cultivation trial at Nietvoorbij, during the 1973/74 growing season the bush slashing treatment again produced a considerably smaller yield and lower shoot growth than the clean cultivation, shallow ploughing, weedkiller and straw mulch treatments. The straw mulch treatment was outstanding; its results were significantly better than those of clean cultivation and shallow lister ploughing. The results with deep lister ploughing and chemical weed control are very similar and also very satisfactory.

The high cost of the straw mulch made it unprofitable at first, despite the favourable results. However, this situation changed when the soil cover stabilised and only half as much straw was required last year to obtain the same degree of coverage. Apparently it will be possible to reduce the amount of straw applied still further.

Wine chemistry and winery technology

The effect of environmental factors on grape and wine quality

In all 508 experimental wines, including 228 cultivar wines, were made in the experimental wineries at Nietvoorbij during the 1974 vintage. In order to ensure reliable results, all experimental wines were made in duplicate.

Cultivar wines were made from grapes from the Stellenbosch, Robertson, Lutzville, Oudtshoorn, Vredendal and Constantia areas. This year wine was

is chromatograph used
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tural Research Institute
separating flavouring
substances in wines



for the first time from 26 new cultivars, the most
rising of which were imported Riesling crossings.

influence of soil type

Soil type is widely recognised as being an
important factor in grape and wine quality. Trials to
determine the bearing and wine quality of grapes from a
n (Chenin blanc) dryland vineyard at Vlothenberg
started last year. The vineyard is growing on two
different soil types, viz Avalon and Estcourt. Total acid
content and bearing were quite clearly higher on the
Estcourt soil than on the Avalon. The better results
obtained on Estcourt, which to all outward appearances
is a poorer soil type (form), may be ascribed to better
moisture conditions.

influence of trellis type on production, yield and wine quality

The trellising and planting width trial at Robertson
vineyard has been established on a typical Karoo soil;
the scion, Steen, was duplicated on the rootstocks
101-14 and Jaquez. It appears that with the

enlargement of the soil area per vine the production per
hectare can be kept more or less constant with the aid of
effective and larger trellising systems.

It was established that various trellising and
planting width treatments result in greater differences in
production per ha in the case of Steen on 101-14 than
with Steen on Jaquez, which produces a very even
yield. The production of Steen on 101-14 was,
however, considerably better throughout than that of
Steen on Jaquez.

With both Steen on 101-14 and Steen on Jaquez
the sugar content differed very little among the various
treatments.

With Steen on Jaquez no connection could be
established between the trellising and planting width
treatments and the points awarded the grapes on the
basis of visual judging or the wine quality. On the other
hand, the results obtained with Steen on 101-14
indicate that with the relatively large soil area of
6,68 m² per vine, and big trellising systems, rather
poorer wines were produced on the whole during the

first five years than with a soil area of 3,34 m² per vine and small trellises. However, in 1973 very good wines were obtained from both Steen on 101–14 and Steen on Jacquez at the higher planting width.

Trellising trial with Cabernet Sauvignon — This trial was established mainly on a Hutton form, with no irrigation, in the Stellenbosch district. Trial data were collected over a period of eight years (1966 – 1973).

Under the cultural conditions of this trial the 1,5 m slanting trellis treatment appeared to produce significantly better than any of the other treatments, without any significant difference in grape and wine quality.

The influence of pressing procedures, grape processing and winery procedures on grape and wine quality

Increase in the percentage good wine recovery and must purity — Trials with Steen and French grapes were carried out last year. The wine quality of French was not impaired by centrifugation or the omission of settling, but the wine quality of Steen was adversely affected by both these treatments.

Enzyme treatment of heated red wine skins — The problem created by heating red skins, a procedure which complicates pressing, was investigated this year with Pinot noir, Cabernet Sauvignon, Cinsaut and Hanepoot. Both pectolytic and proteolytic enzymes were used for the trial.

The results show that in the case of the cultivars Cabernet Sauvignon and Pinot noir the total drained must (free-drained plus pressed) was far higher when the enzymes were added together than when they were added separately or when no enzymes were used.

Experimental wines made in 1973 showed that whether or not enzymes were added during heating made no significant difference to the quality. Neither were there any significant differences in colour intensity between wines that had received enzyme treatment and those that had not.

Transportation

The effect of transportation on grape and wine quality is considered important. Many farms are situated far from wineries and their grapes are transported over long distances.

The cultivar Steen, St Emilion and Colombard were again used for the trial, as during the 1973 vintage. Wines were made from grapes transported unprocessed, as is customary, from grapes destemmed and then transported, and from grapes that had not been

transported at all. The distance was 180 km, and the grapes were transported during the day this year so that the effect of higher temperatures on the quality of both the grapes and the wines made from them could be established.

Experiments last season showed that Steen travelled best and St Emilion worst. As was expected, poorer quality wines were made from the lower quality St Emilion grapes. Where St Emilion grapes were crushed and destemmed before they were transported better wines were produced than from grapes transported uncrushed.

Determining the optimum stage of maturity for pressing — The optimum stage of maturity of Steen grapes has been investigated every year since 1971. In 1973 French grapes were included in the experiment. During the first three years researchers concentrated on the effect of skin contact (24 hours, 20°C); in 1974 free drainage was used for all treatments.

The best Steen wines so far have been obtained from must with the following sugar contents (the harvesting dates are given in brackets):

Treat- ment	1971	1972	1973
Free- drained	16°B (1/3/71)	— —	20°B (28/3/73)
Skin contact	15°B (23/2/71)	20°B (22/2/72)	21°B (8/2/73)

As the table shows, there was no fixed pattern. In 1971 the 20°B skin contact must also produced a fairly good quality, however, and it would appear that must with a sugar content of 20°B to 21°B also produces good results when the skin contact method is used. The results also show that optimum maturity for Steen grapes for the skin contact treatment occurs earlier than when the ordinary free drainage treatment is used. Skin contact was also responsible for the development of the “Steen character”.

In the case of French grapes both the skin contact and the free drainage treatments produced the best quality at the highest sugar content (18°B).

Testing a new horizontal continuous wine press — The claim that a new imported American continuous wine press produces 20 to 30 per cent more juice recovery than conventional precrushers was investigated.

The Division of Agricultural Engineering measured the efficiency of the press at various speed settings and found that the press does produce higher juice recovery. It was established that 20 per cent more juice is obtained

the cultivar Steen and 24 per cent more with the var Colombard with the aid of this press.

Wines made with this press will be evaluated by a panel at a later stage.

Bouquet substances and related components in brandy, wine and grapes

Specific bouquet substances

Bouquet substances in wine are an important factor in determining quality. Quantitative analysis of these substances is carried out in order to make the more objective determination of quality, to confirm the organoleptic judging, possible.

Last year the "heavy sweet" flavouring substance dominant in certain late harvest wines was isolated. This substance is dimethyl sulphide (DMS) and a gas chromatographic analytical technique is being applied to make quantitative determination possible. Wines judged by the organoleptic method will be analysed for DMS by the gas chromatographic analytical method and the correlation between this substance and quality (bouquet) will be determined.

Occurrence and effect of certain esters

Steen grapes were harvested at various sugar contents and it was found that a certain volatile wine component (ethyl C8 ester) shows a highly significant

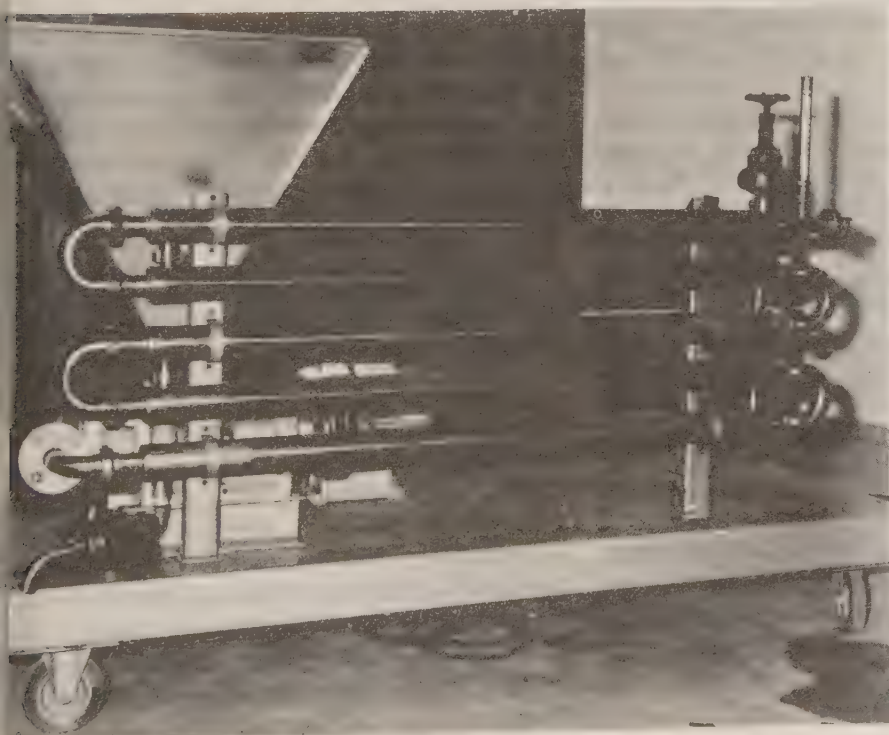
correlation with wine quality. This correlation is at present being investigated and studies are being carried out in order to determine the factors in grapes that affect the formation of this ester in wines, so that wine quality can be predicted by analysing the grapes.

Developing a system for judging the external appearance of wine grapes

Visual judging standards for the grading of wine grapes — During the past two seasons (1973 and 1974) grapes from which experimental wines were to be made were judged on the basis of a number of external grape qualities immediately before harvesting. The object was to establish reliable quality standards for grapes from the point of view of wine quality later on. The percentage of the crop of individual vines affected was estimated by visual means while the grapes were on the vine and each property was noted.

From 20% to 25% of the vines in a particular treatment showed dry botrytis rot, secondary botrytis rot, oidium, bird damage, mealybugs, dust and/or soil, pesticide residues, sunburn, squashy ripeness, flaccid berries, shattering or millerandage. Colour, bunch size, berry size, bunch compactness and skin toughness were also noted.

The average figure for each of these properties was obtained in order to calculate the correlation between a particular property and wine quality as determined by a panel of experienced judges.



A tubular heat-exchanger used for the preparation of red wines by means of heat extraction

The use of sorbic acid as a stabiliser is at present permitted in most wine-producing countries, but there are wide differences of opinion about the advisability of using it and the permissible concentrations. In 23 countries the legally permissible concentrations vary from 200 to 2 000 mg of sorbic acid per litre. In South Africa biological inhibitors in wine have not received much attention so far, but the stabilisation of wines that are fairly low in alcohol, especially semi-sweet wines, undoubtedly deserves more attention.

Experimental work was therefore undertaken with Steen must to observe the effect of sorbic acid (applied as potassium sorbate), with or without sulphur dioxide, on alcoholic fermentation. When sorbic acid only was used as an inhibitor it was found that over 300 mg per litre was required for the effective suppression of fermentation. However, the sorbic acid concentrations required for stabilisation dropped to 100 mg per litre if 130 to 150 mg of sulphur dioxide per litre was added to the must. If the total sulphur dioxide content was further increased to 200 mg per litre, stabilisation was found to take place at 75 mg of sorbic acid per litre.

The use of sulphur dioxide remains essential in practice, since sorbic acid treatments cannot control bacterial contamination effectively.

Fungal infection of corks for bottling

Flavours and odours from fungi and other contaminants in corks can seriously impair the quality of bottled wine, and a series of experiments was carried out to determine the sterility of corks from the various suppliers.

The findings indicate that there is little difference in sterility between pre-treated corks and untreated corks. Gamma irradiation of the corks for 10.5 hours at 3 megaroentgens effected total sterility in all cases.

Corks from bottles of wine disqualified by a panel of judges on the grounds of mustiness showed severe contamination with *Penicillium* spp. in all cases. Further findings indicated that the alcohol percentage in dry wines, which varies from 10 to 16 per cent, inhibits the development of *Penicillium*, but does not suppress it entirely.

It has been concluded that contaminated corks, especially corks contaminated with fungi, are the cause of musty odours in wines and that a large percentage of commercially available corks are contaminated. Corks used for bottling wine should therefore be tested for sterility and sterilised if necessary.

The effect of fungicides on fermentation and wine quality

Benomyl — Various sprayings with benomyl at a concentration of 50 g per 100 litres were applied to a block of French grapes. The number of sprayings in the various treatments varied from 0 to 4 and spraying was done at specific stages in the growth of the vines.

It appeared from the results that if benomyl is applied no later than twenty days before harvesting, the residue is too low to have any effect on fermentation.

Benomyl can therefore be recommended as a fungicide for wine grapes, especially for the control of botrytis *Botrytis cinerea*, even when treatments are required until shortly before harvesting. A safety period of 20 days before harvesting is recommended, however, but this is considerably shorter than in the case of copper compounds, for which a safety period of eight weeks is recommended.

Metiram — In order to determine the effects of this fungicide on fermentation and the hydrogen sulphide content of wine, various quantities of metiram were added to grape juice and fermentation was started with an inoculum. It appeared from the results that 200 mg per litre and 400 mg per litre retarded the fermentation process by 8 and 12 days respectively. This fungicide also resulted in the formation of the most hydrogen sulphide.

Metiram can therefore have considerable adverse effects on fermentation and wine quality if it is used too shortly before harvesting. No definite period has so far been established.

Dinocap (wetable powder) — Various quantities of the fungicide were added to grape juice and fermentation was started with an inoculum. Not even the recommended concentration, at which the poison was applied, had any effect on fermentation, and the amount of hydrogen sulphide formed did not differ significantly from the amount formed in the control.

Dinocap (dusting powder) — This had no effect on fermentation either, and the hydrogen sulphide formation was insignificant.

Dinocap wettable powder and dusting powder can therefore be applied right up to and even during harvesting, if conditions so require.

Sulphur (dusting powder) — No effect on fermentation could be observed. However, sulphur produced the highest hydrogen sulphide formation after metiram. Although the amount of hydrogen sulphide formed was far lower than the threshold value, it would be safer not to apply this preparation shortly before harvesting.

Diseases and pests

Aerial and underground fungus and

Bacterial diseases

Crown gall on young vines from a nursery — Crown gall was identified on young vines from nurseries by means of a special method. The symptoms on these young vines were excessive callus tissue formation at graft unions and places where buds were cut out before rooting.

Symptoms that did not correspond at all to the normal symptoms of crown gall were identified on sultana shoots by means of this method.

Bacteria were also isolated in an apparently healthy shoot from a vine infected with crown gall. This is proof of the fact that *Agrobacterium tumefaciens* is systemic in plants.

Phytophthora cinnamomi — At the beginning of the experiments it was known that this root fungus kills R99, Rupestris du Lot, Rupestris St George and R110 under field conditions. It has now been proved by means of isolations and inoculations that the fungus is also the cause of sudden death in 101–14.

Phytophthora cinnamomi was isolated from a shoot 75 cm above the ground. In a R99 parent plantation where shoots lay along the ground the fungus was isolated in the shoots in several places. Treatment of these shoots with a 0,5 per cent Chinosol solution for six hours had no effect on the fungus. Infected shoots therefore constitute a source of infection.

Soil on which an infected vineyard block had grown up to two years previously was tested for the presence of this fungus. Positive isolations were obtained on virtually the entire area. The fungus was also isolated from old roots and shoots that had remained in the soil.

It can therefore be concluded from experimental results that the fungus is able to grow through the soil from an inoculum source such as a colonised shoot and colonise other nutrient sources. Old nursery or vineyard soil therefore has to be thoroughly purified from old material before it can be replanted to vines.

Phylloxera

Resistant rootstocks

In the Vredendal area ten different rootstock cultivars are being tested by the Plant Protection Research Institute to determine their resistance to phylloxera. The tame Steen vines which were included as a control have already all died from phylloxera.

It has been found that the resistance to phylloxera of Jacquez, 333 and Metallica is significantly lower than that of Rupestris du Lot, 3306, Richter 110, 143B, Salt Creek, 101–14 and Richter 99. It has also been found that Rupestris du Lot has significantly lower resistance than 3306, Richter 110, 143B, Salt Creek, 101–14 and Richter 99.

Chemical control

A number of chemical preparations are being tested against phylloxera in the Vredendal area. C-46 (hexachlorobutadiene) applied at 360 kg per ha produced 100 per cent control up to a year and four months after application. During the past season the population again increased and now, two years and four months after treatment, there is 73 per cent control. The other preparations had no significant effect on the phylloxera population.

So far no improvement in growth vigour or production has been found.

Margarodes

A survey was carried out by the Plant Protection Research Institute in the Malmesbury area to determine the incidence and distribution of vine margarodes *Sphaeraspis capensis*.

Forty farms where vines are grown were chosen at random from a possible 87 and investigated. Twenty-five per cent of these farms were found to be infested with margarodes.

Since most of the vineyards are in the Paardeberg region, the infestations were found mainly in that area. The infested vineyards consist of a total of about 180 000 vines.

Two of the best phylloxera-resistant rootstocks, viz Richter 99 and 101–14, are attacked and killed by margarodes in that area. The infested vineyards generally die in patches, but cases of entire vineyards deteriorating as a result of this insect have been recorded.

The survey showed that margarodes are a far more serious problem in South African vineyards than was previously supposed.

Growth arrestment disease

In the 1972/73 and 1973/74 seasons, as in 1971/72, farmers continued with a recording system for sultana vineyards in the Lower Orange area. Useful records were received for 240 sultana blocks in 1972/73 and for 190 blocks in 1973/74. About a third of the blocks originally classified as diseased are seriously

diseased. In these cases production was less than 10,5 metric tons per hectare each year.

It would appear from the data collected during these three years that there is no fixed pattern in the incidence of the disease among the rest of the blocks. Some blocks are diseased every second year, and the rest may be either diseased or healthy for two successive years. It would appear that the diseases sultana vineyards of the Lower Orange area show a slightly better production during the years when they seem healthy than vineyards that are constantly healthy, probably because of having rested the previous year. The production of healthy vineyards is about 23 tons per hectare.

With regard to cultural practices, no significant differences were found between diseased and healthy blocks.

CITRUS

According to the Citrus Exchange 46 per cent of the total citrus crop for 1972/73 was exported, the gross proceeds being R79 019 155, 19 per cent was sold on the local fresh market for a gross of R7 068 000 and 35 per cent was processed by local factories, the gross proceeds in this case being R2 992 319.

The net income was 51,49 per cent of the total gross proceeds of R89 079 474.

Fruit quality — The new fully automatic apparatus for determining rag strength that was put into service by the Citrus and Subtropical Fruit Research Institute offers interesting opportunities for making a thorough study of the toughness of the rag and peel.

Production problems of the looseskin cultivars

Ortanique — The effect of natural and artificial cross pollination and girdling on the production of this cultivar was determined.

Production was trebled by cross pollination with Valencias without seed content being increased to an unacceptable level. Girdling also raised the yield and the application of both measures resulted in a five-fold increase in fruit set. The average number of seeds where no cross pollination was possible was nil, and where cross pollination did take place only 3.

Marsh and Ruby grapefruit were also evaluated as possible commercial pollinators for Ortanique. According to hand pollination trials these two grapefruit

cultivars should have the same effect on Ortanique production as Valencia.

Clementine — According to the results of hand pollination trials natural pollination of the cultivar Clementine by Valencias and Tomangos should have a good effect on production. There are, however, no large commercial orchards where this deduction can be tested in practice.

Minneola and Orlando — No suitable source of pollen, such as was found for Ortanique and Clementine, could be found for these cultivars. Apparently girdling and the application of growth regulators can be considered for Minneola and Orlando.

Ortanique fruit cracking — Apart from production, fruit cracking is the biggest problem in Swaziland-grown Ortanique; it sometimes constitutes a problem in the Republic as well. This year fruit cracking was fairly generally observed in Clementine and o looseskin varieties.

Pock-marked peel — As the name indicates, pock-marked peel is an abnormal condition of the skin of the orange. The condition is characterised by depressions, generally occurring in patches, which appear a few days after harvesting and are usually only noticed at the ports.

Some farmers maintain that the symptoms occur in the orchard, but an investigation by the Citrus and Subtropical Fruit Research Institute showed that these symptoms are not the same as the condition known as pock-marked peel, and are probably a type of pre-harvest oleocellosis.

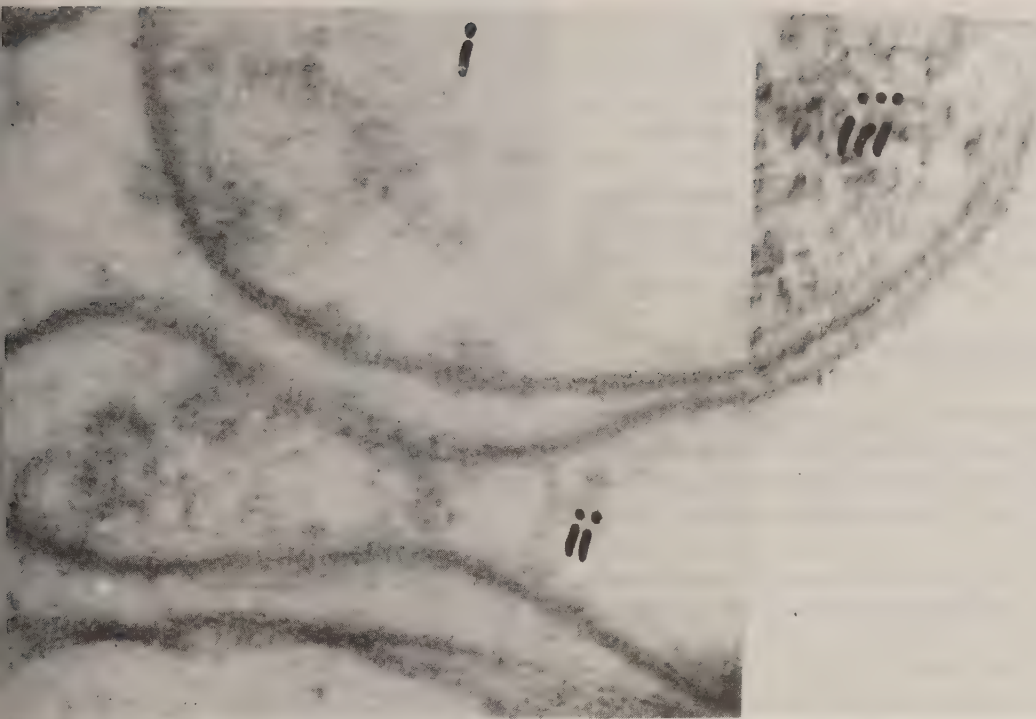
The problem is a major one, particularly in view of the fact that a few growers are suffering great losses as a result of fruit being condemned at the ports.

Breeding looseskin cultivars — A fairly extensive breeding programme for selecting naartjies has been started. The following monoembryonic cultivars were used as the female parents: Ellendale, Clementine, I Robinson, Wilking and pompelmous. The male parents were: Novelty, Tomango, Salustiana, a pollen-producing navel mutant and Marsh.

The seed was planted at Messina. As soon as the seedlings are a few cm high trees that have been cut back at Nelspruit will be top-worked onto the crossings. Recent trials have shown that this kind of top-working means that fruit can be harvested a mere three years after the planting of the seed.

Breeding scions for resistance to black spot

Two of the selected bitter orange x grapefruit crosses were back-crossed with Marsh grapefruit and the



Composite photo showing the difference between the greening organism, which attacks citrus, and the actual mycoplasma-like organisms: i and ii are mycoplasma-like organisms and iii is a greening organism. All three were photographed at the same magnification

was planted. These two crossings show no symptoms of black spot, although the fruit on the bounding trees is showing very severe symptoms.

Citrus Improvement Programme

This programme was drawn up with the aim of making State-certified parent trees available to the industry. The parent trees include all commercially important cultivars and rootstocks. Only virus-free trees were selected on the basis of productivity and fruit quality in the chief citrus-producing areas of the country considered for certification.

Meanwhile a comprehensive investigation has been started to find the best available trees to use as parent trees for the present. All registered citrus nurseries in the country have been asked to participate in the scheme. 32 of these nurseries have responded to the request to submit parent trees. After strict selection the 5 000 potential parent trees were reduced to 323, which were found at 12 nurseries. These nurserymen said they were prepared to make buds available to other nurseries.

Planting trials

The trials were established at the Zebediela Estate in the Sundays River Valley during 1970, in every

case on both light and heavy soils. The trees were measured in April 1973 and tree volume determinations were carried out. The trees are still young, but the preliminary indications are that the Vapam and Temik treatments are the best.

Chemical weedkillers

A great deal of attention was given to the use of chemical weedkillers and excellent control of weeds, even nutgrass, was obtained with certain contact preparations and systemic compounds.

Of the preparations compared the most promising were Glyphosphate, bromacil, diuron, Paraquat, and a mixture of diuron and Paraquat.

Mulches

The effect of cultural practices and plastic covers was investigated.

The response of young citrus trees to plastic covers and chemical weedkillers has been constant for the past five years. These two treatments produced significantly more fruit than the grass culture plots with hand cultivation between the rows. The mass per fruit did not differ significantly for the different treatments, although

the plots with a low production yielded decidedly bigger fruit.

The fruit from the plots with plastic covers had the highest solids content and its rag was the softest.

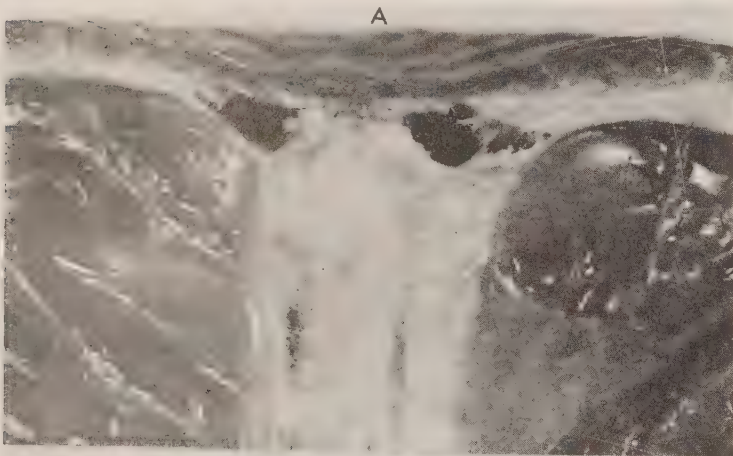
The general conclusion is that in citrus trees growth vigour, productivity and quality are promoted by the use of a plastic cover.

Cultivation and fertilising

Fertilising trials with grapefruit and lemons lasting three seasons were conducted in various areas in the Lowveld and Natal. The object of the trials was to establish optimum leaf standards for purposes of analysis and determine the effect of fertilising on yield and fruit quality. In the case of grapefruit the high nitrogen values in the leaves were accompanied by poor internal fruit quality.

A phosphate response can only be expected if the soil phosphate is under 12 ppm. With 240 ppm of potassium in the soil only a small increase in yield is obtained with higher potassium applications. It was also found that if too high a level of nitrogen was applied the lemon yield was reduced and the fruit was smaller. Optimum leaf standards for grapefruit are 2,3 to 2,5 per cent nitrogen, 0,11 to 0,12 per cent phosphate, about 0,9 per cent potassium and 5,0 per cent calcium, for lemons the standards are 2,3 per cent nitrogen, 0,10 per cent phosphate and 1 per cent potassium.

An investigation has shown that the magnesium content in the leaves is due to a low magnesium content in the soil — a condition which goes hand in hand with soil acidification. The availability of magnesium is, however, determined by the quantity of magnesium in the soil, the soil pH and the calcium:magnesium ratio. Soil analysis is therefore necessary: the magnesium status in particular has to be watched.



Fruit-cracking and rot in the Ortanique thin skin at the style end of the fruit leads to fruit-cracking (B) and rot (C)

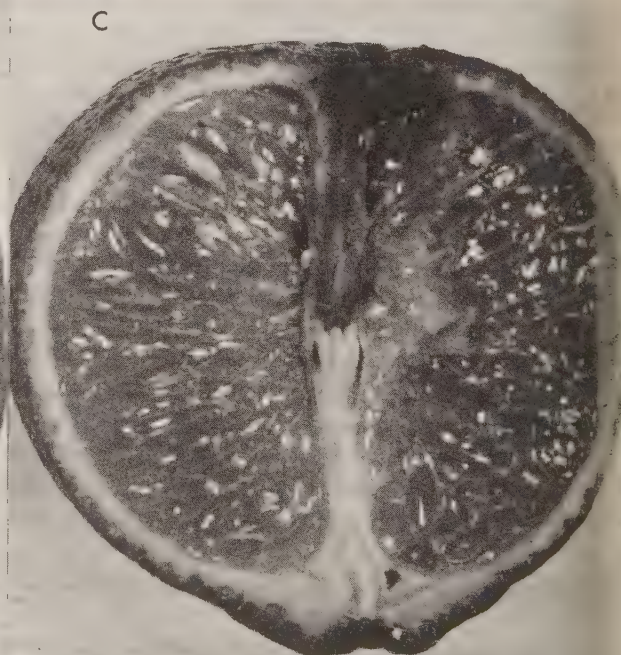




Figure 1. Development of *Phytophthora* collar rot in a young citrus tree by stem girdling, followed by the application of a fungicidal paste to the wound

Diseases and pests

In trials carried out at Rustenburg (triazophos and phenthoate (Cidial) gave promising results for the control of citrus thrips *Scirtothrips citri*. In addition, very encouraging results have been obtained using soil systemic insecticides against thrips. These pesticides are taken up by the roots of the tree and therefore have very little effect on natural parasites of red scale.

Experiments in the areas where red scale *Aonidiella aurantii* is particularly difficult to control have indicated that the biological control of this pest is very promising.

The introduced parasite *Comperiella bifasciata* has been established on red scale in the Transvaal Lowveld, Rustenburg and at Citrusdal. It is more effective than the indigenous parasite *Habrolepis rouxi*. The parasite *Phytomyza melinus* has also been established at Citrusdal, and it now occurs in most citrus areas.

Field trials have shown that citrus nematodes, *Tylenchulus semipenetrans* can be controlled economically, effectively and safely with DBCP.

Five trials were conducted on various soil types in various parts of the country and no phytotoxicity was observed in any of the trials. A new granular nematicide has performed well in preliminary trials and is now being tested extensively. It can be applied to the soil as either as a granular or a liquid formulation.

Rough lemon seedlings transplanted from beds fumigated with methyl bromide and DBCP into fumigated old citrus soil and new nematode-free soil showed greater growth increases in the new soil. However, the growth increase was far greater in the DBCP seedlings than in the methyl bromide seedlings.

The conclusion drawn was that methyl bromide suppressed the symbiotic mycorrhiza in the soil of the seed bed to such an extent that no re-establishment of mycorrhiza took place. The result was that food intake was not satisfactory. Consequently growth was poor in the methyl bromide seedlings.

This conclusion was corroborated by the incidence of scab *Sphaceloma fawcetti* on the young trees. The methyl bromide seedlings were far more susceptible to this disease, a further indication of persistent nutritional imbalance.

It is therefore becoming increasingly important that seedlings grown in soil fumigated with methyl bromide should be re-inoculated with mycorrhiza. Until a method of re-inoculation can be found, leaf applications of nutrient elements to plants from soil fumigated with methyl bromide will remain necessary.

Investigations of *greening disease* were continued, with the emphasis on electron microscope studies of the causal organism and control studies using stem injections of antibiotics.

Initial electron microscope studies carried out in France and South Africa indicated that the agent was a mycoplasma-like organism. In February 1974 Moll (C.S.F.R.I. Nelspruit) and Martin (Natal University, Pietermaritzburg) observed the presence of an external membranous wall outside the cytoplasmic membrane. Since true mycoplasmas are surrounded only by a thin membrane, the greening organism appears to be more closely related to a bacterium than to a mycoplasma.

Various antibiotics were applied by tree injection into the stems. Treatment with certain tetracycline formulations resulted in a lower incidence of greening and a higher fruit yield compared with the controls. Further experiments showed that some tetracycline formulations were ineffective. Better results were

obtained when the first year's treatment of tetracycline was followed in the second year by a five-fold increase in dosage. A rise in the percentage of greened fruit in the controls was recorded in the second year, probably as a result of a reinfestation by the citrus psylla.

Nevertheless, the antibiotic injection in these trials also resulted in a lower percentage of greened fruit than the previous year. With regard to time of application it was found that the antibiotic solution was taken up most rapidly during September and this treatment also resulted in the most effective disease control.

Impietratura disease, caused by a virus, is characterised by small, hard fruit, a hardened flavedo; the rind usually has anything from a few to many gum-infiltrated protuberances each surrounded by a yellow halo. It has been recorded in several Mediterranean countries. Similar symptoms to the above have been seen on grapefruit in orchards at Nkweleni, Zululand. There was also an increase in fruit drop, which is another symptom of impietratura.

Boron deficiency has been eliminated as a possible cause. No spread of the condition appears to have occurred at Nkweleni during the past year. Indexing trials are being conducted at Nelspruit and Pietermaritzburg to establish whether the disease is impietratura or not, but so far no positive results have been obtained.

A survey was made in the Eastern Cape and Eastern Transvaal citrus areas and it was found that several of the largest citrus nurseries and various young plantings showed signs of *collar rot* and *gummosis*.

In co-operation with the Citrus Exchange, an extensive experiment was conducted in a young disease grapefruit orchard where selective tree surgery was applied and then immediately followed by the application of various fungicidal pastes to the wounds. The infected trees showed a marked recovery 9 months after tree surgery when either copper oxychloride or commercial fungicide paste treatments were applied to the wounds. Potassium permanganate, previously the standard treatment, was no better than the untreated control.

Harvesting and handling

In an effort to streamline the handling of fruit destined for export to Japan and certain other overseas markets, experimental fumigation of export fruit has been carried out. In these experiments nearly 100 000 fruit flies and 16 000 false codling moth larvae were artificially placed in oranges, lemons and grapefruit for the tests. The results obtained with EDB fumigation have been extremely encouraging and it is expected that the citrus industry will start commercial trials shortly. In

addition, fumigation work was carried out on fruit and insects from Swaziland, at the request of the Swaziland Government.

Storage of low temperature sterilised fruit

The results of the initial tests conducted on grapefruit subjected to 24 days at $-0,5^{\circ}\text{C}$ before being held at the optimum storage temperature of $11,0^{\circ}\text{C}$ for a further 4 months showed that low temperature sterilisation against insects in no way adversely affected the keeping quality of the sound fruit.

These results indicate that it may be possible to store South African grapefruit — sterilised by holding at $-0,5^{\circ}\text{C}$ for 24 days — at the optimum storage temperature of $11,0^{\circ}\text{C}$ for two to three months before arrival at overseas markets.

Pre-cooling of citrus fruit using an air delivery temperature of $-0,5^{\circ}\text{C}$ may be safely used to reduce fruit temperature from ambient to the carrying temperature, which is $4,5^{\circ}\text{C}$ for oranges and $11,0^{\circ}\text{C}$ for grapefruit and lemons.

It was found that late-harvested navel oranges are very susceptible to rind pitting and such fruit is very subject to chilling injury. Navel oranges should therefore not be allowed to hang on the tree too long.

The results were so convincing that the Perishable Products Export Control Board is already using the temperature mentioned when rapid precooling of citrus is required to speed up the throughput of the precooling stores.

SUBTROPICAL FRUIT

Avocados

According to the survey on avocado production completed recently the commercial avocado areas are confined to the Lowveld areas of the North-Western, North-Eastern and Eastern Transvaal. There are about 473 500 avocado trees in South Africa and a great increase in production is expected.

One of the chief problems of the industry is rapid deterioration in avocado orchards, chiefly as a result of root rot and the sunblotch virus disease.

Experimental work on the keeping quality of Fuerte avocados was started: fruit was stored at various temperatures ($7,5^{\circ}\text{C}$, $5,5^{\circ}\text{C}$ and $3,5^{\circ}\text{C}$) for four weeks to simulate the transit period to England. After storage the fruit was kept at 21°C to allow it to ripen and the

fruit was then examined for internal and external defects. The fruit stored at 3,5°C ripened four days later than fruit kept at 7,5°C.

Cold damage occurred on all the fruit stored at 5,5°C. At 5,5°C only a very slight degree of cold damage was visible, and there was no cold damage in fruit stored at 7,5°C.

Storage at lower temperatures encourages silver and vascular bundle browning.

Spots were observed in the edible parts of fruit stored at 7,5°C, whereas fruit stored at the lower temperatures did not show this problem.

The effect of various concentrations of carbonic acid gas on the keeping quality of Fuerte avocados was investigated. Fruit for this trial was obtained from three orchards, viz Nelspruit, Duiwelskloof and Louis Trichardt, and stored at a temperature of 5,5°C in atmospheres containing 0, 2 per cent, 4 per cent and 6 per cent carbonic acid gas. After 9, 18, 27 and 36 days samples were taken and stored in a normal atmosphere at a temperature of 21°C for ripening.

The ripe fruit was examined for internal and external defects and the rate of ripening was determined.

A high percentage of carbonic acid gas delays ripening. No carbonic acid gas damage was evident. Fruit stored for a long period ripened faster after the storage period than fruit stored for only 9 or 18 days.

Initially there were very few internal or external defects in the fruit, but these increased as the storage period was extended.

Observations show that rough handling of the fruit during storage and cold damage are not related. Surface lesions are not very visible after storage. This underlines the fact that avocados require very careful handling.

Diseases and pests — There were exceptionally few fruit fly infestations in avocados this year. The eggs are laid under the skin of the fruit, but the larvae do not hatch and it is assumed that the fleshy parts of the avocados are unsuitable as food for the larvae of the fly.

Various experiments were conducted using a number of promising chemicals as drenches for the control of root rot *Phytophthora cinnamomi* on avocados in the glasshouse and potted plants in the open field. Even with weekly applications applied over a long period, not one of the fungicidal drenches was able to eliminate the pathogen from both the soil and the roots.

Plastic soil covers for avocados were tested to determine their influence on growth, production, fruit quality, moisture conservation and a number of other matters.

The trees under plastic bear better and flowering and fruit set appear to take place earlier. Fruit samples were picked during March and analysed for oil content. The oil content showed a difference of 8 per cent in favour of the cover. The practical significance of this is that fruit produced under plastic covers can be marketed earlier.

Fertilising — The fertilising requirements of avocados are relatively low and in practice overfertilising is fairly general. According to the results of fertilising trials, overfertilising can have a very bad effect on production.

Soil and leaf analysis is the only effective way of determining the optimum fertilising level for a particular planting. Fortunately the value of this technique is being appreciated to an increasing extent by producers, as the 240 per cent increase this year in the number of samples received for analysis from farmers shows.

Bananas

There has been a noticeable increase in plantings during the past year. Up till last year the area under bananas in South Africa was approximately 7 000 hectares, divided up as follows;

Burgershall/Kiepersol	2 166 ha
Levubu	1 565 ha
Letaba	1 107 ha
Kaalrug/Malelane	693 ha
Natal South Coast	1 500 ha

The major problem with the industry is the cyclic production of fruit which at this stage is most unpredictable.

Of the seven Cavendish selections being tested on a larger scale three are showing great promise. One of the three selections may be released during the coming summer.

A trial to determine the loss of mass in bananas during ripening showed that the loss is about 1 per cent during a six-day ripening programme.

In a comparative trial where three types of irrigation were compared at three levels of application the following results were obtained:

Overhead irrigation — 32,6 kg per bunch on the average; dragline irrigation (under tree) — 35,3 kg; and drip irrigation — 34,0 kg. These differences are not significant.

Research on the burrowing nematode *Rodopholus similis* is nearing a close and a great deal of information has been collected. All cases reported in the Transvaal have been eradicated and the permit system of checking plant material is being well utilised by farmers. It has been found that burrowing nematode attacks most commercial crops with the exception of papaws, onions, radishes and pineapples.

Although new nematicides such as phenamiphos are effective in reducing the population of nematodes on established plantings, a more economical proposition appears to be pre-planting fumigation, dipping of plant material and the use of *Rodopholus*-free planting material. Rotation crops such as *Eragrostis curvula*, Katambora Rhodes grass and siratro are also effective in reducing the *Rodopholus* population.

Mangoes

On the basis of tree numbers obtained during the survey on mangoes, an increase of about 300 per cent in production appears to be possible. During the past few years a bacterial disease caused by *Pseudomonas mangiferaeindicae* has become a serious threat.

Trials were carried out to determine the best picking stage and storage temperature for a number of mango cultivars.

The following table sums up the results:

Cultivar	Picking stage	Storage temperature
Zill	Cannot be stored for long	
Haden	Ripe	7 – 10°C
Kent	Ripe	± 7°C
Peach	Medium	± 7°C
Sabre	Cannot be stored for long	
Long Green	Medium ripe	± 10°C

A trial was carried out to determine the effect wax on the colour development of Sabre, Peach, Long Green and Haden mangoes. It is clear that wax products do not affect the colour development of the fruit adversely. Other wax preparations specially intended to restrict the physiological activity of the fruit to an absolute minimum do limit the colour development of the mangoes.

Losses due to mango bacterial spot were particularly heavy during the 1973/74 season. The increase in severity of the disease can be attributed to the unusually high rainfall experienced during the early part of the 1973/74 season. The best control was obtained by spraying with copper oxychloride.



The root area of this 5-year-old avocado tree has been covered with a plastic mulch. It formed flowers in abundance compared with other trees of the same age without a plastic mulch that bore only small flower buds.

Where sufficient labour is available, the use of hard canopies to protect mangoes against bacterial infection may prove economically feasible. The canopies effectively reduced the amount of moisture on the fruit.

There was, however, a marked increase in scale populations under the canopies and a tendency for the fruit to colour up irregularly.

The effect of various fungicides applied at room temperature and 55°C on the shelf-life of Peach mangoes was investigated. After treatment, the fruit was kept at 5°C for 21 days (simulated shipping conditions) and then held for several days to ripen, so that both ripening and disease development could be determined.

From the results it appears that both TBZ and benomyl (1 000 ppm) were the best treatments. TBZ was used in the best-looking fruit, and benomyl provided slightly better disease control than TBZ, but was slightly phytotoxic to this particular mango cultivar.

In another post-harvesting experiment the effect of benomyl and TBZ dip treatments (55°C for 5 minutes) was tried in combination with 75 krad gamma radiation for the control of anthracnose and soft rot of Peach mangoes. This work was done in conjunction with the Atomic Energy Board at Pelindaba. The heated benomyl and TBZ treatments resulted in good control of both diseases. Once again it was the benomyl treatment, although slightly phytotoxic, which gave the best disease control.

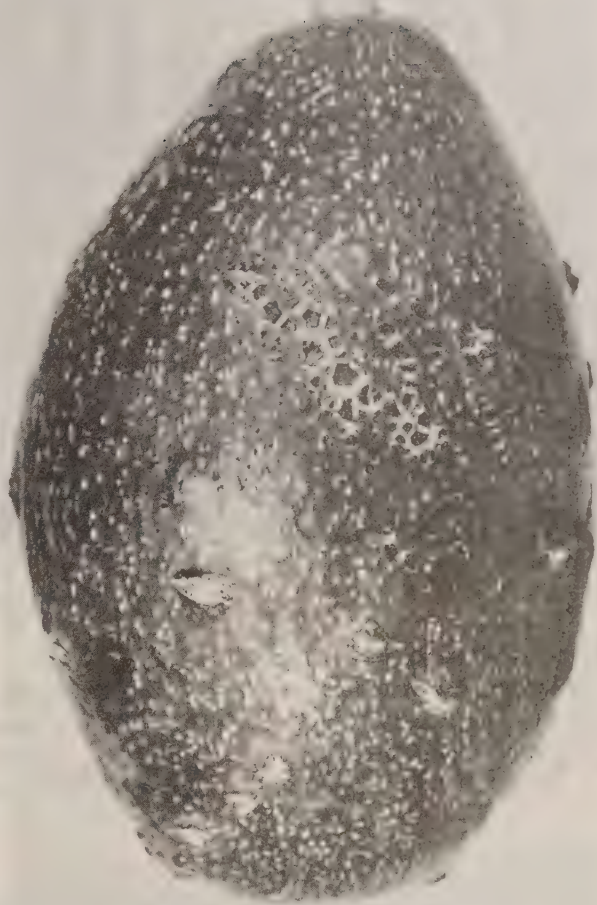
A similar experiment was conducted with Haden mangoes. The experiment was enlarged to include 0, 50, and 100 krad irradiation together with each fungicide treatment. Heated benomyl (55°C for 5 minutes) alone and heated benomyl in combination with gamma rays were the most effective treatments. Higher irradiation doses proved to be slightly phytotoxic to the fruit.

aws

The biggest horticultural problem with pawpaws is breeding cultivars with the desired internal and external characters. Cross-pollination of pawpaws takes place so that new cultivars soon disappear unless the pawpaws are propagated by means of hand pollination.

An experiment was conducted to determine the effectiveness of different fungicides on post-harvesting disease development in pawpaws. The best disease control was obtained by dipping fruits in a hot (51°C) benomyl solution (1 100 ppm) for 12 minutes.

Promising results were also obtained with benomyl (1 000 ppm) and a temperature of 51°C for 12 minutes.



An avocado with scars caused by egg-laying of fruit flies

Granadillas

The granadilla industry in South Africa is relatively small with an estimated 2 000 hectares under granadillas. Interest in the growing of this crop has spread to the Eastern and Western Cape. In these areas *Passiflora edulis* is the most suitable species and bears mainly during the summer months.

There is an increased interest in grafting the purple species onto the more tolerant yellow species. A trial is now in progress to evaluate the economic benefit of grafting versus planting seedlings.

Several granadilla species are being tested for rootstock purposes in an attempt to improve on the present yellow species. The remaining hybrids were all discarded as they were not as good as the purple species.

In a granadilla longevity experiment at Burgershall Research Station the fungus *Phytophthora parasitica* resulted in a high mortality of the purple granadilla vines in nearly all treatments after three years. The yellow



Drip irrigation is applied shortly after a young banana plantation was established

When the banana plants are fully grown overhead irrigation is used

granadilla vines, on the other hand, were virtually completely resistant.

In a similar experiment at Nelspruit the yellow granadillas were the only surviving plants after three seasons. Initially, purple granadillas budded onto yellow rootstocks appeared very promising, but the vines eventually succumbed as the budding was done too close to the soil level and the foot-rot infection spread to the scion, probably by means of mud-splash. It is therefore strongly recommended that vines be budded onto yellow rootstocks at a height of at least 0,5 to 1 metre above ground level.

Guavas

About 13 000 tons of guavas is produced annually, only about 4 500 tons is sold on the nine national markets. The remaining quantity is used for processing, chiefly into fruit juice. Production has remained virtually constant over the last few years, but large plantings were established in the Transvaal during the past year.

A number of promising seedling trees were discovered last year, but unfortunately the fruit of most of the trees was of the white type which is unacceptable to the processing factories.

One new selection was made, bringing the present total to 25. These trees are now undergoing strict tests to find the best variety for marketing. The cultivar Fan Retief is still recommended for commercial planting.

The litchi industry in South Africa is well established and is growing slowly as regards tree plantings and production. At present litchi production for a good season exceeds 1 000 tons. Litchis are marketed mainly in South Africa as fresh fruit.

Export prospects for litchis are good. About 100 tons of fruit a year is exported at present.

An investigation of the control of post-harvest decay of litchis by means of hot water and heated fungicide dip treatments was conducted.

Promising control of decay was obtained with a series of hot water dip treatments, the best of which was a 3 minute dip at 50°C. Good control of the post-harvesting disease was also obtained with 2 fungicide dip treatments at 50°C for 13 minutes.

Pineapples

The estimated tonnage of pineapples processed in the Republic during the year under review was 115 000 tons with overall production at about the same level as that of the previous year, that is 172 000 tons. Current market trends indicated a promising future for pineapple cultivation.

The tendency for large farmers to expand their production and for smaller farmers to stop producing has continued over the past year.

Nematodes — The price of several commonly used fumigants has more than doubled during the past year. This has made the decision of whether to fumigate for nematode control more critical.

Several new systemic post-planting treatments for pineapples are being evaluated. Promising results have already been obtained with the use of phenamiphos (Demacur) and oxamyl (Vrydate) as pre- and post-planting treatments.

Weed control — Screening tests have shown certain chemicals to be effective post-emergence herbicides against *paspalum*, but these herbicides also proved very phytotoxic to pineapple plants when they came into contact with their foliage.

Post-emergence application of new weedkillers gave good control of *Euphorbia prostrata* and *Physalis peruviana*. Neither of these herbicides appeared to be phytotoxic to pineapple plants.

Plant selection — Four Smooth Cayenne clones have now reached the final state of testing in which their

respective growth and yield characteristics will be compared with that of field-run material.

Canning tests were carried out on a promising Queen selection which bears fruit with an average mass of 2 kg. The fruit provided a canned product which had a very compact flesh and excellent colour.

Mealybug — During summer very heavy infestations of the pineapple mealybug *Dysmicoccus brevipes* were recorded on a few scattered farms in the Eastern Cape. Laboratory studies show that ladybird beetles (Coccinellidae) are efficient predators of mealybug and provide an effective means of biological control.

Climatological research — Climate affects the incidence of certain pests, diseases and physiological disorders of fruit (such as sunburn, leathery pocket and black heart) which cause serious losses to pineapple farmers each year.

In an attempt to gain a better understanding of the relationship between climate and the growth, yield and pests and diseases of pineapples, a series of weather stations is being erected in the Eastern Cape to cover the coastal belt from the Kei River mouth to Alexandria.

The meteorological data collected will be analysed and related to the performance of pineapple plants in order to study those problems of pineapple production which are influenced by climatic factors.

Diseases and pests — A major development is taking place in the field of nematode control in pineapples. Trials have shown that fields can be kept virtually free of nematodes for at least 16 months after planting by the regular application of systemic preparations to the leaves of the pineapples. The pesticides are apparently translocated downwards to the roots where they prevent the development of the nematodes.

In addition to suppressing nematodes, one of these products appear to have a generally beneficial effect on the growth of the plants.

VEGETABLES

The planning, erection and completion of several new municipal markets and the increased turnover of fresh vegetables at these markets indicate that growth is continuing in the vegetable industry in all the production areas.

During the past year the position of tomatoes as the most important vegetable crop was further

strengthened. In addition to the increase in sales on the fresh market, the demand for processed tomato products, especially tomato paste, showed the same tendency as in the rest of the western world. The factories had been alarmed because tomato paste was being imported from Europe at competitive prices, but a world shortage developed virtually overnight. At present the position is that a good export market could be created if local production expanded sufficiently.

Green beans for canning and quick freezing were seriously damaged by bacterial blight. Manufacturers are so concerned about this state of affairs that they have asked the Institute to speed up the release of promising breeding strains that are resistant to this disease.

The production problems previously experienced with green peas grown for canning and freezing are still increasing. Many of the established production areas showed poor results during the past year and shortages were experienced. Every effort is being made to find new production areas. The Research Institute is doing all it can to help identify such areas. Production techniques and methods are tested on a co-operative basis in areas that might have potential.

In view of the good prospects for exporting fresh vegetables to Europe during the northern winter the Horticultural Research Institute offered a short course before the start of the planting season last year for producers interested in export crops, such as green beans, green peppers, muskmelons, asparagus, egg fruit and artichokes. However, fresh vegetable exports did not come up to expectations. Copious rains in the summer rainfall area hampered the production of vegetables, especially green beans, bell peppers and muskmelons, and an abnormally large number of problems cropped up, especially with regard to diseases, both in the field and in packed products. Large quantities of vegetables were rejected after inspection on account of infection with various fungi and bacterial organisms.

Enquiries about exporting sweet potatoes to England were received from several sources. Apparently there is a steady demand, especially among the Non-White population group, for sweet potatoes with a red skin and white flesh.

The Horticultural Research Institute has started packing and storage trials at its three biggest centres with a view to evaluating the keeping quality of the most important cultivars, identifying storage problems and testing packing materials. Post-harvest rots such as soft rot of sweet potato *Rhizopus nigricans* and *Fusarium* dry rot have already been identified.

Fungal diseases in sweet potatoes were virtually unknown in the past, but these diseases appear to be increasing and causing problems. During the past year a

few diseases — in particular foot rot *Plenodomus destruens* and blotch *Pythium* species — have appeared in the Transvaal Lowveld.

The great interest shown in the production of onions two years ago has continued. More and more farmers are changing over to direct sowing to save labour and make early marketing possible. This has obliged producers to buy better planters. A large number of imported precision planters were purchased during the year.

Tomatoes

The breeding programmes are largely concerned with the development of new cultivars that are resistant to disease such as bacterial wilt *Pseudomonas solanacearum*, fusarium wilt *Fusarium oxysporum* and *F. lycopersici*, and bacterial canker of tomato *Corynebacterium michiganense*. Efforts are also being made to breed cultivars with particular growth habits such as dwarf types. Such properties are particularly desirable in market and canning tomatoes. The fruit quality of canning tomatoes also received attention.

A considerable amount of work on the breeding of dwarf-type market tomatoes has already been done in the Lowveld, but no outstanding breeding strains have been found as yet. Fruit quality and firmness in particular have not been up to standard.

Seventeen breeding strains, including imported "resistant" strains of Hawaii (Nos. 7750 and 7755), were tested under controlled conditions for resistance to bacterial wilt. With the exception of the strains L105 and L2036, all the strains were found to be extremely susceptible. The canning tomato breeding strains were also found to be extremely susceptible.

Suitable breeding strains for canning were evaluated at Roodeplaat in co-operation with the National Food Research Institute. The dry matter content of breeding strains and cultivars was determined by means of refractometry. The breeding strain 1360 produced the highest dry matter content, viz 7,17 per cent. The figures for the breeding strains L1027-1 and L1028-1-1-3 were 6,48 per cent and 5,50 per cent respectively, and for the cultivars Roma VF and Napoli they were 5,06 per cent and 4,58 per cent respectively.

The paste of 12 tomato specimens was also examined. The cultivars Ventura and Napoli and the breeding strain 1246-2-1A produced paste of a satisfactory consistency.

Breeding work in the winter rainfall area (Elsenburg) was aimed chiefly at developing cultivars resistant to the spotted wilt virus. Strains showing no symptoms of virus infection were selected from crossings

h Rey de los Temporanos (an introduction from South America), *Lycopersicon pimpinellifolium* and *L. esculentum*.

Cultivars

Cultivar trials with market tomatoes were undertaken in various parts of the country. In the Lowveld the cultivar Heinz 1370 did best under both winter and summer conditions. The yield from this cultivar was very good and so was the quality. The breeding strain LL1103-2-1-1 (Manapal x Heinz 1370) also produced good yields, with exceptional firmness and the absence of defects such as fruit cracking and catface. In a cultivar trial with canning tomatoes under winter conditions the breeding strains L1028-1-1-1-3 and L1027-2-4 and the cultivar Napoli produced considerably higher yields than the cultivar Roma VF.

The new nematode-resistant cultivar Rossol also produced good yields under both winter and summer conditions. Other breeding strains with promising colour characteristics were also tested. The quality of the fruit, and the colour and firmness in particular, were excellent.

In cultivar trials at Roodeplaat under very unfavourable summer rainfall conditions the cultivars Heinz 1370 and Walter produced the highest tonnage, but Walter tomatoes were very big and were subject to catface. Heinz 1370 and Campbell 17 were to a minor degree subject to leaf diseases.

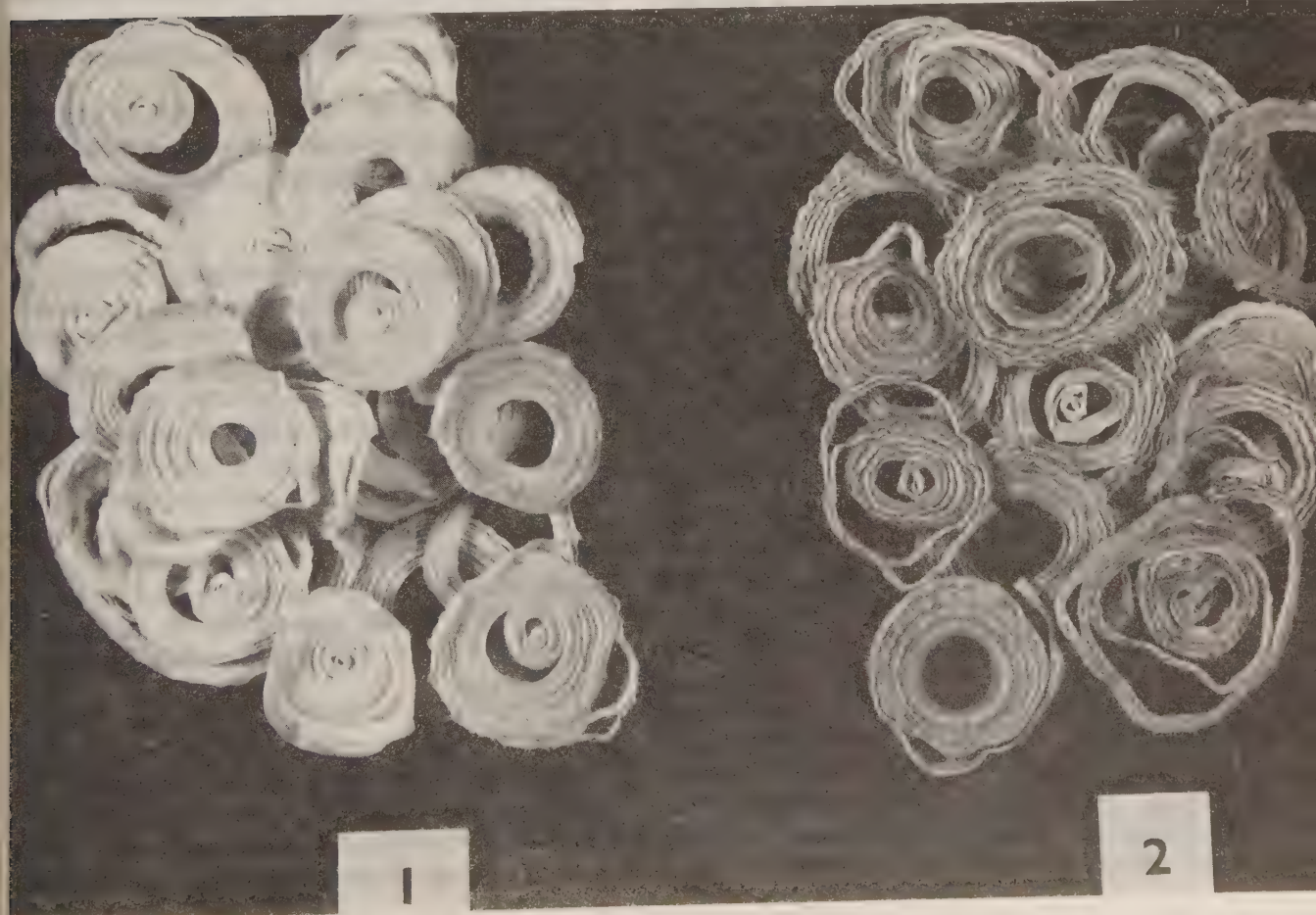
Canning tomatoes were evaluated under the same conditions. The cultivars Napoli and Roma VF produced very good yields, and Napoli also made the best showing under unfavourable conditions.

A number of tomato cultivars were evaluated at the Elsenburg Experimental Farm. Special attention was paid to the keeping quality aspect. The cultivars Moneymaker and Heinz 1370 have for two consecutive seasons proved to be relatively resistant to cold injury. All the other cultivars showed a high incidence of cold injury when held at $-0,5^{\circ}\text{C}$ for two weeks.

Cultivation

Espacement trials in the Lowveld with dwarf-type canning tomatoes and ordinary canning tomatoes again

Dehydrated onion-rings of an American cultivar (1) and of Excella Bon Accord (2)



showed that yields can be increased by the use of high plant populations. Plant populations of 166 666 plants of dwarf-type canning tomatoes per hectare not only produced a higher yield but also a more concentrated crop. Trials with ordinary canning tomatoes with this particular growth habit showed the same tendencies.

Pilot trials aimed at stimulating the ripening of tomatoes under winter conditions were also carried out in the Lowveld. Spraying the plants with Ethrel (2-chloroethyl phosphinic acid) at concentrations of 500, 1 000 and 2 000 ppm and 1,500 litres per hectare accelerated ripening, but also caused a drop in the fruit mass. Both the higher concentrations damaged the plants. These trials were replicated under summer conditions with a spraying of Ethrel at 500 ppm and a 2 000 litre solution per hectare. In this case the effect was not as evident as under winter conditions. Ripening takes place normally in summer, but is delayed in winter by low temperatures.

Espacement trials with dwarf tomatoes at Elsenburg confirmed that a higher yield can be obtained with a higher plant population, although the fruit mass drops.

Diseases and disease control studies.

A technique was developed for determining the resistance of cultivars and breeding strains to bacterial canker *Corynebacterium michiganense* in the glasshouse. Of the cultivars tested Roodeplaat Premier showed a certain degree of resistance and a high degree of resistance was found in strain 344 012 of *Lycopersicon pimpinellifolium*. This strain can therefore be used as a parent in the breeding programme.

When plants of the most important cultivars were artificially infected with *Verticillium dahliae* it was shown that most of these cultivars are susceptible to the disease. Cultivars deliberately bred for resistance to this disease showed a high degree of resistance. It was found under field conditions that artificial infection with this disease can lead to a crop reduction of 28 per cent. A series of isolations of *V. dahliae* showed that this pathogen occurs generally on tomatoes at Roodeplaat and in the region of Muldersdrift.

Green beans

The green bean crop, one of the most important vegetable crops, was attacked by a heavy natural bacterial blight infection as a result of the fairly moist conditions of the past season. This disease became a major hazard during the past season and did a great deal of damage. "Blight" is really an umbrella term for three different bacterial diseases whose symptoms appear very similar. They are known as halo blight of beans

Pseudomonas phaseolicola, bean blight *Xanthomonas phaseoli* and fuscous blight *X. phaseoli* var. *Fuscans*.

Halo blight is the most important disease and its name refers to the round, watery spots that appear on the pods. The symptoms of the other two blights are very similar to those of halo blight.

The nature and extent of bacterial blight during the past season again emphasised the necessity of developing disease-resistant cultivars for canning. At present there is not a single good disease-resistant cultivar available that can be used by factories for large-scale production and can be mechanically harvested. Matters became so critical during the past season that some of the canners resorted to fresh market cultivars such as Seminole and Badie which are not suitable for processing, because of poor pod quality, unless they are picked young.

Because of the lack of disease-resistant canning cultivars the breeding programme is directed at developing the necessary cultivars; good sources of resistance are available. Two good disease-resistant breeding strains are 265/61 and 68/779, which are now undergoing thorough testing.

Sweet potatoes

Many new breeding strains were tested and a number of seedlings seemed very promising; the strains 71-12-6 and 73-1-67 were exceptional. The two breeding strains will be tested in different cultivation areas during summer.

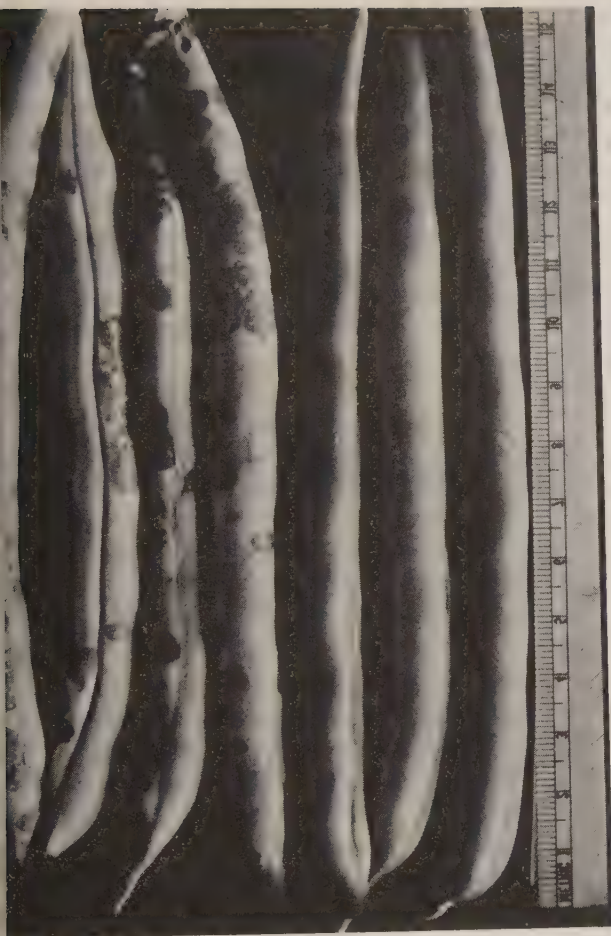
The cultivars Brondal and Koedoe were virus purified this year by means of heat therapy and growing point culture techniques.

The following quantities of virus-free runners were supplied by the Department to sweet potato growers this year: Impala — 53 000, Mafutha — 50 000, Eland — 13 000, Hoenderspoor — 8 000 and Griekwa — 6 000.

Results obtained by producers show that the virus-free propagation material of the sweet potato cultivars Impala, Mafutha, Eland and Griekwa is performing far better than the old material they used before. Lowveld producers of Brondal say that they have achieved a 100 per cent increase in production from some of the virus-free cultivars. At the Institute at Nelspruit the virus-free Impala cultivar raised production by 300 per cent.

Cabbage

Many trials with cabbage have been carried out during the past few years and most problems have been solved. The only breeding research project was the



Symptoms of fat-spot disease on the pods of a green bean cultivar (left) that is not resistant to the disease

multiplication of breeders' seed of the cultivar All Head (Horticulture selection) at Roodeplaat. Cultivation and production research was confined to cultivar and spacing trials.

Interest in cabbage growing has increased enormously in the O.F.S. and North-Western Cape. This crop is very easy to grow and suitable cultivars are available, namely Gloria Osená, M.S. Cross and C.O.H.R. Cross. Gloria Osená adapts well to the warm weather experienced in the O.F.S. Region, and C.O.H.R. Cross adapts very well.

In the Winter Rainfall Region the highest yields were produced by Gloria Osená, C.O.H.R. Cross and C.G. Cross. These yields were produced with the closest spacing tested, viz 45 cm x 45 cm.

Cauliflower

Cauliflower breeding research was continued at the Horticultural Research Institute with a view to developing new cultivars with a maturation period of up to about 90 days, in order to fill the gap in the short

season and midseason group. Good cultivars such as Snowball, Canberra and Snowcap are available to meet the need for varieties with a maturation period of over 100 days.

Researchers are looking for a cultivar that is resistant to disease, produces heads of good quality and size and has a luxuriant foliage with the young leaves tightly folded around the head to protect it, particularly against sunburn. New breeding strains are still at the development stage and breeding research is continuing.

Cultivar trials in the Free State showed that Cumulus, Snowball, Snowdrift, South Pacific, Canberra and Snowcap are the most suitable cultivars for this area.

A cultivar planting time trial was carried out in the Winter Rainfall Region. Fifteen cultivars were tested at 12 different planting times, spaced at intervals through the year. Satisfactory yields and head quality were obtained from the third planting (15 December) to the fifth planting (20 February) when Snowball and Early Snowball yielded particularly good results. With other planting times the results were poor.

A strong negative correlation was found between the yield from a cultivar and the number of days from sowing to transplanting, i.e. the longer the plants remained in the seed bed the poorer the yield.

Broccoli

The breeding strain B1-1 and an early selection of the cultivar Medium 90 are producing excellent results. Trials are being carried out on a commercial scale at nurseries. The breeding research will finish during 1974, but seed of the most promising breeding strains is being maintained with a view to release at a later date.

Green peas

The research programme was started in order to find a green pea cultivar of good quality and appearance that is suitable for a single harvesting. According to trials at Roodeplaat and Glen the cultivars Venus and Mars have the most important properties such as high yield, good seed colour, blunt pods that can easily be shelled mechanically and a concentrated harvesting period. Although the seeds of these cultivars are considered too big by canners they are attractive and soft.

Cultivars with small seeds, such as Fertigolt, Planet, Greenfeast and Yanco Packwell, have most of the qualities mentioned but are not quite up to standard in respect of one quality or another. For instance, Greenfeast and Yanco Packwell have sharp-pointed pods and Planet has light green seeds.

Planting time trials carried out at Glen indicate that green peas produce very high yields there provided the seed is planted between 1 July and 15 August. According to these results the production potential for green peas in the irrigated areas of the O.F.S. and North-Western Cape is high.

Asparagus

Interest in and the demand for fresh and canned asparagus are still increasing. The industry still depends on the two standard cultivars Mary Washington and California 500.

The Horticultural Research Institute is at present evaluating two new cultivars and four breeding strains received from France. During the second year of the trial two of the breeding strains and the two new cultivars were seriously affected by fusarium wilt. There appears to be a great difference in susceptibility.

Muskmelons

The breeding of muskmelons suitable for export was continued at Elsenburg. The progeny of Honey Dew x Haogen crossings seemed more promising than that of other crossings.

The exporting of muskmelons by air from the Transvaal to Europe seems to have possibilities. Nine of the most suitable cultivars for this purpose were tested by the Horticultural Research Institute in two important production areas in the Transvaal. The plantings were damaged by the copious rains, but in the circumstances the cultivar Saticoy performed best; the popular cultivars Haogen and Elsche suffered severe sunburn.

Three cultivars were planted under cover in plastic tunnels. Haogen and Vedrantais were very well adapted and produced well. Saticoy, on the other hand, did not adapt well with regard to growth habit and proved to be very susceptible to leaf diseases.

A fungal disease *Trichothecium roseum* (fruit rot), which has not been observed before, occurred on Vedrantais. Research on this disease is continuing.

Pumpkins

The inbreeding of the Van Niekerk selections of the flat white Boer pumpkin was continued during the past season with a view to producing an improved Boer pumpkin with large fruit, attractive appearance, good internal quality and good keeping quality.

Although variation still occurs in all the breeding strains, some are fairly stable, but as yet none is so significantly better than commercially available cultivars that it can be released.

Mosaic is one of the most important diseases of pumpkins and gem squashes. A comprehensive study of the ecology and biology of aphids was started with the aim of achieving better insight into the incidence and distribution of the mosaic virus. Control techniques were tested and one of the conclusions reached was that spraying with a light mineral oil does not give good control. However, promising results were obtained in the Lowveld with an aluminium foil cover on the ground between the plants.

Onions

There was a country-wide shortage of onion seed during the past season. The greatest demand was for the cultivars Pyramid and De Wildt.

A sowing time trial with onions for dehydration showed that the breeding strain 29 B-2-1-2 gave the best results.

At the Horticultural Research Institute two improved selections of the cultivar Sphinx made a very good showing. Seed is being multiplied with the aim of replacing the old cultivar Sphinx in due course. Two canning cultivars, Alba and Atjar, produced good results, but they are very susceptible to *Alternaria*. The cultivar Pyramid produced better results than De Wildt in respect of bolters and split bulbs.

Breeding strain No.322 has performed very well during the past three years. In the Lowveld, too, it was one of the best cultivars in a sowing time trial and produced the highest percentage of lesion-free onions at the various sowing times.

With a view to the keen demand for dehydrated onions at present, the suitability of eleven cultivars for dehydration was tested. These included two cultivars that are commercially dried in the USA. Although these imported cultivars had good fry ratios and an attractive light colour, they cannot be recommended for cultivation since they are not adapted in the Winter Rainfall Region. Apart from a poor yield per hectare, many of the onions are so small that the losses during processing are very high. The crossing 29 B-2-1-2 and Excella Bon Accord performed best. However, these two cultivars have the disadvantage of producing a slightly yellow product, whereas a light colour is preferred in dried onions.

Garlic

The espacement trials showed that an espacement of 5 cm in the row gives a significantly higher total yield than 7,5 cm or 10 cm. The last two espacements produced the same yield. The closest espacement also produced significantly more large bulbs than the wider treatments. Here it should be mentioned that a diameter

of 45 mm, the minimum size for the best grade on the export markets, is nevertheless a fairly small bulb.

The later plantings in the sowing time trials produced lower yields. The irrigation results show that garlic does respond to regular irrigation. Plots subjected to a high soil moisture tension produced a significantly lower yield than the rest. It is also apparent that garlic can withstand a dry period better during the early vegetative growth stage than during bulb formation.

Bell peppers

In the course of an evaluation trial with eight cultivars it was found that Keystone Resistant Giant, Tugela and California Wonder produced the best yields. During the trial no problems with insects were experienced and diseases were only a minor problem. Tobacco mosaic caused the characteristic mosaic symptoms on the leaves and a rather coarse skin texture.

The average fruit mass dropped as the harvesting season advanced. For instance, the fruit mass of the most popular cultivar California Wonder dropped from 152 g at the beginning of the season to 64 g at the end. The quality of all the cultivars was exceptionally high throughout.

Egg fruit

This crop is still relatively unknown to the local consumer, but producers are showing greater interest in the crop, especially with a view to exporting.

In an evaluation trial of ten promising breeding strains at the Horticultural Research Institute a severe infection of *Verticillium dahliae* (wilt) was experienced for the first time. None of the strains is able to resist this disease. The strains were specially bred for resistance to bacterial wilt, caused by *Pseudomonas solanacearum*, which is a big problem, particularly in the Lowveld.

Several strains have good resistance to this disease and were finally selected this year. Fruit quality and yield were also taken into account. Yields of up to 55 tons per ha were obtained.

Gem squashes

The ordinary gem squash changes from a speckled light green to yellow in a very short time, sometimes even before reaching the market. Over the past five years a dark green gem squash that does not turn yellow, even after being stored for a month or more, has been developed. Most of these breeding strains used to be rather on the big side, but strains have now been developed that have a mass of no more than 280 g to 300 g, as against the mass of 200 g to 250 g of the ordinary Little Gem.

These promising strains are now being commercially tested and seed is being multiplied.

NUTS

Pecan nuts

At present there are about 50 000 pecan nut trees in the Republic and about half are in production. The total crop from the trees in production is between 175 and 200 tons of unshelled nuts a year. The entire crop is consumed locally.

Nuts to the value of about R2 million are still imported annually and sales opportunities for locally produced nuts are therefore very favourable.

Various pecan nut cultivars are tested annually and compared for production, nut quality and resistance to scab — a virus disease which can spread rapidly in humid areas with a high summer rainfall. The fungus disease can be controlled, but there are cultivars with a high degree of natural resistance to the disease. New cultivars are therefore selected primarily for their resistance to scab.

A survey showed that the cultivars *Barton*, *Desirable* and *Choctaw*, which are recommended for commercial planting at present, are still free of any symptoms of scab.

The cultivar *Wichita*, which produces good crops of high quality nuts every year, is susceptible to scab, however. The cultivars *Apache*, *Comanche*, *Sioux* and *Mohawk* are also susceptible.

The cultivars *Elliot*, *Candy* and *Puruque* are all resistant to scab, but produce very small nuts. *Elliot* yields well, but *Puruque* bears a very small crop. In view of the small nuts and low crop *Puruque* produces, it can be ruled out entirely.

The latest cultivars imported, viz *Caddo*, *Cherokee*, *Cheyenne* and *Shawnee*, have shown resistance to scab so far, but require further testing.

A germination trial was carried out during the past season with seed of new cultivars and the following results were obtained: *Barton* — 80 per cent germination, *Choctaw* — 68 per cent, *Elliot* — 68 per cent, *Desirable* — 63 per cent, *Puruque* — 53 per cent, *Wichita* — 51 per cent and *Comanche* — 21 per cent.

Three insect species were observed on pecan nut trees at Nelspruit for the first time, viz:

Apate monachus, the black coffee stem borer, was found to have bored tunnels into the stems and branches of live pecan nut trees. *Dysdercus nigrofasciatus*, a

Under favourable climatic conditions
macadamia trees bear bunches of nuts



cotton stainer, feeds on the leaves and green nuts. These nuts showed black spots on the kernels after they were harvested. Another insect found was *Popillia bipunctata*, a beetle that feeds on the leaves and young branches of young pecan nut trees.

Macadamia nuts

The prospects for macadamia nuts seem very promising. According to data already obtained in South Africa the yield from these trees compares favourably with the production figures given for Hawaii.

During the year under review the cultivar Kau was imported from Hawaii, but is still under quarantine. This cultivar will be tested for production and nut quality.

One of the recently released cultivars, Nelmark 1, is producing rather poorly because of pollination problems. With self-pollination only 5 per cent of the

bunches on the cultivar produced any nuts, whereas with cross-pollination the figure was 32 per cent.

Experimental results indicate that more attention should be paid to interplanting with other cultivars, to bee and other insect activity.

Almonds

The world market for almonds is very large and undersupplied. In South Africa very little attention is paid to this fruit because it has never been able to compete with other types of fruit, such as peaches.

Renewed efforts have been made to encourage commercial cultivation by means of evaluation plantings in several places and the importation of popular overseas cultivars.

Trial plantings of almonds are at present being undertaken at five different places in the Republic and

Following cultivars are being tested: Texas Prolific, Drake's Seedling, Brand's Jordan, Jordan, Britz, Shell, Nonpareil, Ne Plus Ultra and Princess n.

Medicinal plants and spices

Interest in the production of these crops and for the production of volatile oils is still rising, as is apparent from the numerous enquiries received during the past year from prospective buyers, and from South African buyers of spices, essential oils and medicinal plants. Several buyers who have virtually all their stocks at present are investigating the possibility of producing these crops locally so that they will be less dependent on overseas supplies.

During the past year a South African wholesale dealer has established fairly large plantings of medicinal crops, particularly *Digitalis lanata*, but also *Vinca rosea* and *Cassia innoxia*. The production of these crops is expected to expand considerably.

With regard to volatile oils, a private firm in Johannesburg which does its own distilling and extraction in a modern factory exported 1,6 tons of processed essential oils to France during 1973, where the oils are blended and mixed with other oils. The firm plans to export 3,2 tons this year (value over R200 000), and to increase production in the near future. The wide range of essential oils this company produces is unique. The company has already received recognition for the South African standard oils it produces and for local oils extracted from *Eriocapulus punctulatus* and *Acacia nama*.

Oil is also produced from acacia and casuarina, jasmine, tuberose, the Seville orange, basil, celery, chamomile, marigolds and khaki weed.

Chief problems — An economic investigation into local sales prospects for medicinal plants and plants from which spices and volatile oils are produced revealed that total South African purchases of the products of these crops amount to under R5 million a year and that net income per hectare from most of the crops compares unfavourably with that from crops such as citrus and grapes. Apart from this drawback, the volatile oils are in demand to meet certain special requirements of the buyer.

In view of these factors it was decided that only limited attention should be given to this group of crops. The Department undertakes chiefly the maintenance of the material which is not easy to obtain and the importing and testing of any new promising plants; research is left mainly to private initiative.

Limited research is still undertaken on crops such as *Digitalis lanata* and *Datura* spp. which offer good prospects for local cultivation.

The Citrus and Subtropical Fruit Research Institute found heavy infestations of three insect pests on *Digitalis lanata*. Two of the pests that occur chiefly on the lowest leaves of the plant are soft brown scale *Coccus hesperidum* and the striped mealybug *Ferrisia virgata*, formerly known as cotton scale. Infested plants were covered with sooty mould as a result of the secretion of large quantities of honeydew by both insects.

The third species found on digitalis is a yellow aphid identified as *Aphis nerii*.

A heavy infestation of *Monolepta variopennis*, a black beetle, about 4 mm long with a red head, was found for the first time on the leaves of *Hibiscus sabdariffa* (which is used for hibiscus tea) at the Citrus and Subtropical Fruit Research Institute. The leaves had been considerably damaged by eating.

STRAWBERRIES

Three strawberry cultivars and eight preliminary selections were tested for yield, freezing quality and keeping quality. The new selection Ti 86-4 performed very well, producing the second highest yield after Parfaite. This selection has excellent freezing qualities and, together with another selection, stood up best to storage. It has the further advantage of having a short production period and producing early fruit with a full red colour.

Interesting results were obtained in a trial of various soil covering methods. Black and transparent plastic, pine needles and uncovered soil were compared for the effect on production, fruit size, time of ripening and production cost. A soil cover of transparent plastic resulted in an earlier peak harvesting period, higher production and earlier fruit than the other mulches and covers. Some cultivars produced twice as much as when grown on uncovered soil.

If, during winter, low plastic tunnels were drawn over the rows to which these soil covers had been applied, production was even higher and the harvesting date was earlier. It was evident that transparent plastic raises the soil temperature and therefore provides better growing conditions for strawberry plants during winter.

One of the problems in controlling botrytis in strawberries by means of irradiation is that softening of the fruit results. Trials were carried out to determine to

what degree this can be counteracted by irradiating strawberries at various times throughout the picking season and at various degrees of ripeness. Strawberries irradiated when they were already a full red colour became completely soft, but those irradiated when they were slightly greener than at normal picking softened only to the normal degree of softness of ripe strawberries. The acid content of these strawberries was also reduced significantly, but these encouraging results were spoilt by the fact that the colour of the strawberries became bleached to such an extent that they appeared "too green" and so likely to arouse consumer resistance.

The stage of the season (early, middle or late) had no effect on the influence of irradiation on the strawberries.

Experiments at Roodeplaat on the biological control of the red spider mite *Tetranychus cinnabarinus* on strawberries (Earlibelle cultivar) with spiders revealed that the species of spider *Pardosa crassipalpis* can control mite populations effectively. So effective is the control that when the crop masses from the experimental beds were converted to tons per ha there appeared to be a difference of 6 tons per ha between the beds where spiders were present and those without spiders.

FLOWERS

The free on board value of export flowers increased from R2 357 000 in 1972 to R2 818 000 in 1973. Cut flowers represented 56,9 per cent of this amount, flower bulbs 30,9 per cent, plants 10,1 per cent and foliage 2,1 per cent. West Germany bought the largest quantity of flowers (28,0 per cent), followed by the Netherlands (23,6 per cent) the U.S.A. (11,9 per cent), England (11,4 per cent) and Italy (5,6 per cent).

The chief export flowers were carnations, chrysanthemums, gladioli, proteas and roses. A few consignments of gladioli were rejected because of rust infection.

Proteaceae

The primary task of the protea research unit was the collection, description and establishment of commercially promising Proteaceae material at Tygerhoek. The 16 chief cut flower species of *Protea*, *Leucospermum* (pincushion) and *Leucadendron* (tolbos) were established, and 27 less important species were established as well. Comprehensive horticultural descriptions of 12 species have also been completed and will be available in pamphlet form shortly.

Studies on die-back syndromes in various *Protea*, *Leucospermum* and *Leucadendron* spp. revealed the following:

1. Proteas did better in unsterilised soil than in sterilised soil.
2. A fungus, probably an *Achremomium* species, attacked *Leucospermum cordifolium* and *L. tottum* in addition to several *Protea* spp. *Leucadendron* spp. were resistant to the fungus.
3. This fungus germinated at a temperature range of 0°C to 35°C, with 25°C as the optimum temperature. At 0°C and 5°C it took about two weeks for the spores to germinate.

Vegetative methods of propagating proteas were investigated with a view to the true-to-type propagation of commercial selections. The most important pincushion protea *Leucospermum cordifolium* can at present be propagated from cuttings with 90 to 100 per cent success. Researchers are now concentrating on the use of protea rootstocks to help solve soil composition, soil-borne disease and drought problems for prospective producers of cut proteas.

An important trend in the industry is the increase in the cultivation of proteas, which is replacing the practice of veld harvesting. The Department has now started a registration programme for commercial Proteaceae cultivars. The registration of the first few protea cut flower cultivars that qualify during the present season is an indication of the direction in which protea production is moving.

The breeding of natural proteas as cut flowers for commercial purposes has been started. About 120 single protea and pincushion plants have already been included in a commercial evaluation programme with a view to releasing new cultivars.

Unprecedented interest in South African cut proteas is being shown in Europe at present, thanks to the sustained advertising of these flowers over a number of years. West Germany and the Netherlands are the principal buyers, and the prospects of expansion to other EEC countries, particularly France, remain good. Expansion in the South African industry is aimed at satisfying the requirements of these markets. Intensive cultivation of cut proteas in orchards is spreading rapidly at present from the Western Cape to other areas, especially the temperate grassveld areas of the summer rainfall area. There are definite indications that it will be possible to market proteas successfully in the East and in the U.S.A. later on.

Dried proteas are being marketed on an increasing scale and this seems to be a promising secondary industry.

For the first time in the Transvaal downy mildew observed at Muldersdrift; brown rust *Phragmidium nanatum* occurred near Marikana.

Serious die-back occurs every year in the rose trees of parent plantations of the Horticultural Research Institute. It has been found that in most cases this can be ascribed to *Verticillium* wilt. The soil profile does not appear to have anything to do with this type of die-back of rose trees either.

Thirteen different rose rootstocks that were tested for resistance to *Verticillium dahliae* all started to die rapidly four weeks after infection. No differences in susceptibility could be observed, if indeed there were differences.

The following symptoms are typical of *Verticillium* wilt: the leaves turn yellow, wilt, curl and eventually drop. Affected shoots then die back gradually from the tips. If new shoots form the internodes are abbreviated and the tree fails to form abnormally large numbers of dwarfed shoots at the stem buds.

During the investigation the trees were treated with Dithionine against red spider. Some of the rootstocks were very sensitive to the preparation and showed scorching. There was noticeably more scorching in the treated than in infected plants.

Virus purification

The following new cultivars were received from the industry for virus purification: 17 hybrid tea roses (indexing not yet completed), 13 floribundas (3 positive for mosaic) and one rootstock (indexing not yet completed).

The following quantities of virus-indexed rose material were supplied to the industry during the past year: 225 000 rootstock shoots, 1 100 cultivar buds, 100 hybrid tea rose trees and 177 floribunda trees.

Gladioli

The pathogen that caused neck rot of gladioli in the Transvaal in January/February 1973 has been described and identified as *Pseudomonas marginata*.

Chrysanthemums

More chrysanthemum cultivars were subjected to virus purification techniques, following fresh demands from the industry. Virus-free parent material of the following cultivars is now available to the industry: Large Red, Large Pink, Large White, Large Yellow, Golden

Wedding, Large Red, Pink Marble, Super White and Super Yellow.

Ancymidol has been tested as a growth regulating agent for dwarfing vigorous chrysanthemum cultivars for use as pot plants. It has been found to be very effective in extremely low concentrations (0,5 mg per pot in 50 ml of water).

Applied as a soil drench it has produced satisfactory dwarfing and plant shape and leaf growth have been especially good after treatment.

Lachenalias

The evaluation of single plant selections is continuing and promising selections are being multiplied for commercial testing. Good results were obtained with a new method of vegetative propagation, with the result that many selections can be tested earlier. This propagation technique will make the production of lachenalias more economic.

A medium for growing tissue cultures successfully from lachenalia bulb scales has been developed. Researchers have succeeded in growing 20 to 30 bulblets in a test tube from a section of bulb scale 1 centimetre square. The method could also be used later for the large-scale multiplication of virus-free or new lachenalia cultivars.

Carnations

It was found that under natural conditions the eggs of the carnation worm *Epichoristodes acerbellae* are laid in clutches of 55, on the average, on both surfaces of carnation leaves. After hatching the larvae penetrate all parts of the plant, where they feed and eventually pupate. Parasites of the egg stage (one species), larval stage (three species) and pupal stage (three species) were found.

A survey at carnation nurseries showed that despite regular chemical control measures the pest occurred on both outdoor and indoor plantings.

It was found that all eggs, larvae and pupae die within 60 to 75 days at 1,5°C. In the course of experiments it was found that parathion, which used to be generally used, only provided 30 per cent control, whereas methomyl provided 90 per cent control.

Pot plants

The increasing population density and numbers of flat dwellers in the larger towns have continued to stimulate the market for pot plants.

Flowering pot plants are especially popular and work on production methods to suit local conditions has therefore been continued at the Horticultural Research Institute.

Poinsettias

Fifteen different cultivars have been studied for their suitability for commercial production. The self-branching cultivars Anette Hegg, Imperial Rochford and the sports derived from them have been found to be especially suitable for year-round production under local conditions. The stock plants produce large numbers of suitable tip cuttings and unlike some of the popular standard cultivars such as Paul Middelsen, a slight drop in temperature during the winter period when the plants are being lighted at night to keep them vegetative does not cause unwanted flower bud formation.

Production time is short, namely 90 to 100 days from cutting to saleable plant, so that it is feasible to produce four crops per annum from a given amount of glasshouse space. The plants are readily kept short and produce attractive flower heads with bracts of excellent quality. They keep in good condition for up to three months under normal flat or household conditions.

Several growth regulating substances have been tested for dwarfing pot plants. Cycocel, B.S.A. 0660 W and Ancymidol were all found to be effective and optimal dosages for different cultivars and for various conditions have been determined.

Pelargoniums

Cuttings of Regal pelargoniums rooted in March and treated with Cycocel (50 ml per pot of 3 per cent solution) have produced excellent flowering pot plants.

Treatment of plants of Carefree pelargoniums raised from seed with Cycocel or Ancymidol reduced the length of the flower stalk and resulted in a more compact plant.

Hibiscus

All varieties and hybrids of *Hibiscus rosa-sinensis* tested have been effectively dwarfed by treatment with low concentrations (0,1 to 0,2 per cent) of Cycocel applied at the rate of 50 ml per 15 cm pot as a soil drench.

The plants remain dwarfed for long periods and if treated with growth regulators and lightly pruned, plants can be maintained as dwarfed pot plants for two years or more.

Fuchsias

Fuchsias can be successfully dwarfed by treatment with Cycocel. Different cultivars vary considerably in their reaction, however.

Cattleya and Cymbidium orchids

Cymbidium mosaic virus is probably present in both species in addition to the previously identified tobacco mosaic virus. It was found in:

A white unnamed *Cattleya*: there were no symptoms on the leaves, but the blooms had countless small water-soaked areas which later became necrotic.

Cymbidium: most leaves had irregular chlorotic areas or streaks. No flowers were produced.

Greenhouse studies

Hibiscus, poinsettias, fuchsias and pelargoniums were grown as pot plants in a compartment clad with translucent white fibreglass. Growth and flowering were excellent and quite equal to that obtained in a compartment under partially shaded horticultural glass at similar temperatures. Light intensity in the fibreglass compartment was very uniform throughout.

Nutrition

More and more instances are being encountered of magnesium deficiencies in pot plants grown for marketing. It is evident that whereas sufficient of other nutrients are applied in pot plant mixtures, magnesium is often neglected.

COFFEE

About 300 metric tons of coffee are produced annually in South Africa at present. The entire crop is consumed locally and about 12 000 tons is imported annually in addition.

One of the problems connected with coffee production is that coffee has to be selectively hand-picked. Trial spraying of coffee trees with a chemical preparation to ensure more even ripening produced very promising results and on a few plots it was possible to harvest the entire crop on the same day. These results are very important to producers and offer a prospect of harvesting crops at a considerably lower cost and with fewer labourers.

Research is being undertaken at present to determine which cultivars yield best in South Africa and

varieties are resistant to coffee rust *Hemileia*
trix. The cultivars SL14, SL28 and SL34 performed
in this respect. Another matter that is receiving
attention is pruning. It has been established that
multiple stem pruning systems give the best production.

TEA

About 3 000 hectares has already been planted to
tea in South Africa, but these plantings are not yet in
production. total production is about 1 242 metric
tons at present, but tea imports still amount to about
10 000 metric tons. It is expected that eventually about

25 per cent of the tea consumed will be produced in this
country.

In a selection trial 31 local tea seedlings were
selected from thousands of plants available for this
purpose. A rooting trial with tea leaf cuttings showed
that an open bed with light shade and treatment of the
cuttings with an antitranspirant preparation give the best
results.

Trials in which mechanical harvesting is compared
with conventional hand harvesting methods are being
undertaken at present. Further trials will be undertaken
to find the best and most economic harvesting
techniques that are compatible with the maximum yield
of high quality tea.

6. Animal Science

BEEF CATTLE

National Aid Schemes

Interest in the National Beef Cattle Performance Testing Scheme has increased to such an extent that the number of members of the scheme rose from 756 to 890 during the past year an increase of 134 breeders.

Number of members, according to regions

Region	1972/73	1973/74	Increase
Transvaal	186	189	3
S.W.A.	177	187	10
Natal	128	148	20
Eastern Cape	107	135	28
North-Western Cape	62	113	51
Free State	81	103	22
Western Cape	15	15	0
Total	756	890	134

The large increase in the North-Western Cape may be ascribed partly to the transfer of 10 herds from the Transvaal office. The number of herds in the Transvaal and S.W.A. was restricted because of the staff position.

The total number of herds represented by the 890 breeders was 1 264, and the three breeds represented best were the Simmenthaler (134), the Bonsmara (125) and the Africander (107).

The bull testing centre at Armoesdvlakte was officially handed over to the Department by the Meat Board last year. The bull station at Queenstown was also completed and opened.

During the past year 706 bulls were accepted for growth tests at the various testing centres.

Percentage utilisation of bull stable facilities

Centre	Capacity for year	Accepted	%	Number that started test	%
Irene	410	339	83	308	75
Armoesdvlakte	220	197	90	187	85
Omatjenne	100	88	88	81	81
Queenstown	100	82	82	82	82

Growth tests for bulls on the farms of owners more than doubled during the past year: 849 bulls were accepted for growth testing as against 403 the previous year. This is 191 more than the 658 bulls which were admitted to central testing stations for growth tests.

This year the practice of taking a few important body measurements was extended to bulls tested on farms. The measurements include measurements of scapular thickness, the pelvis and the growth of hooves. A problem under intensive feeding conditions, especially with the indigenous breeds.

Feed evaluation

The first results obtained with the open track exchange apparatus for farm animals were encouraging from the point of view of the development of methods of feed evaluation. A study with a normal production showed that the actual net energy value of ration corresponded very closely to the value estimated according to the methods of calculation of overbodies.

Chemical treatment of low-grade roughage

The following is a simple process for the chemical treatment of low-grade roughage: The roughage (hay or straw) is coarsely ground with the aid of a hammer mill and then passed through a specially designed tunnel where caustic soda is sprayed onto it. The roughage is then processed into feed blocks. In this way the *in vitro* digestibility of low-grade roughage is raised from 40 to 50 per cent to over 70 per cent. Stock receiving treated feed grow considerably better than those on untreated feed.

At the Institute this treatment has already been successfully carried out with maize straw, *Eragrostis curvula*, *Cenchrus ciliaris*, veld grass and kikuyu hay. A concentration of 5 per cent seems to be ideal for the practice.

Breeding, feeding and management

A fertility trial with Africander cows at Armoesdvlakte and Vaalharts includes the use of hormones to synchronise oestrus and early weaning of calves to break lactation anoestrus. By weaning the calves at 6 to 7 weeks and rearing them by hand it was possible to reduce the lactation anoestrus by almost 75 days on the average.

Of the animals that received hormone treatment 88,5 per cent exhibited oestrus during the first three days. A total of 97,5 per cent of the animals became



The progeny of year-old crossbred Jerseys in excellent condition after being fattened for 148 days after weaning

gnant within six days. This may be considered a very successful synchronisation.

Because of the inherently low fertility and low birth rate of Africander cattle, research was undertaken at Vaalharts to determine the most suitable type of beef breed bull for use in a cross-breeding programme with Africander cows. One of the aspects that received special attention was the effect of the type of the bull on dystocia (calving problems in the cow).

The cross-bred progeny of the Africander cow almost invariably shows a considerably higher growth rate under intensive as well as extensive conditions than pure-bred Africander. At weaning age the mass of calves of the first generation was almost 15 per cent higher and at 24 months the difference was 20 per cent.

Under feeding pen conditions Brahman-Africander crosses did not do much better than pure-bred Africanders, but under extensive conditions they did very well. On the other hand, the Charolais, Hereford and Simmenthaler crosses did very well in the feeding pens. It would appear that the crosses of the lean types such as the Charolais and the Simmenthaler perform better in the feeding pen, but the progeny of the Africander thrives better under extensive conditions.

Cross-bred heifers were watched for the appearance of puberty before the age of 18 months. Except in the case of the Brahman crosses, all the cross-bred heifers attained puberty earlier than the pure-bred ones. Cross-breeding produced a great improvement on the pure-bred Africander. Over 85 per cent of all the cross-bred heifers were pregnant at 20 months, whereas only 28 per cent of pure-bred Africander heifers were pregnant at that age.

The calves of the cross-bred heifers that calved at 30 months had an average mass of 164 kg at weaning age, as against the average of 138 kg for the pure-bred Africanders.

One may therefore conclude that mating beef breeds with the Africander can make a great contribution to more efficient meat production.

At the Armoedsvlakte Research Station bulls of the Blonde d'Aquitaine, Charolais, Chianina and Limousine breeds are being tested for the production of cross-bred slaughter cattle. Africander cows are being used as the dams and semen of the above-mentioned breeds has been obtained from Europe. This is the first time that the Blonde d'Aquitaine and Chianina breeds have been used for breeding purposes in South Africa. Preliminary results indicate that all these breeds, which

represent a large-framed, lean type, are not suitable for use with a pure breed such as the Africander, because of the high birth mass of the calves and the consequent risk of dystocia.

The results of a long-term production trial at the Mara Research Station very clearly indicate the extent to which beef production can be increased merely by applying certain basic principles such as correct veld utilisation, herd management, selection and breeding. In 1962/63 the average beef production per cow per annum from the breed with the highest production was 154 kg, whereas during the past year this figure rose to 214 kg per cow for the breed that showed the highest production.

The profitability of finishing oxen of various breeds and cross-bred oxen immediately after weaning or after they have been run on veld for a year after weaning was studied. The profit from finishing weaner oxen was R14,60 per ox, but the profit for oxen a year older was only R6,30 per ox.

Weaner oxen that had been given access to creep feeding for four months prior to weaning showed a lower profit after finishing than oxen that had received no creep feeding. The respective figures were R12,54 and R16,67 per ox.

Of the four pure breeds included in the trial, viz. Africander, Hereford, Bonsmara and Simmenthaler, the Hereford was by far the most profitable, with a total profit of R20,58 for creep-fed and R24,30 for control oxen. For practical purposes there was no difference in profitability between the various Hereford/Africander and Simmenthaler/Africander crosses, although the three breed cross Hereford/Simmenthaler/Africander showed a lower profit.

The financial results of finishing oxen a year after weaning showed that oxen that received concentrate supplementation at a level of half their energy requirements for rapid growth for the duration of the dry period after weaning but were then run on green summer veld with no supplementation showed a smaller profit (R4,67 per ox) than oxen that received no supplementation and were run solely on veld grazing up to a year after weaning (R9,53 per ox).

Among the cross-bred oxen the Hereford/Africander and Hereford/Simmenthaler/Africander crosses showed higher profits than the Simmenthaler/Africander crosses.

A comparison of maize silage, stook maize and mature maize plants showed that the nutrients in silage are utilised significantly better than those in stook maize and mature maize plants. In the course of this investigation it was established that the loss of dry matter in mature maize plants is over 30 per cent.

Eighteen-month-old Africander oxen were profitably finished at Potchefstroom on rations consisting of 5 kg of maize silage plus a protein concentrate plus maize meal fed *ad lib*.

A comparative meat production study was carried out with bulls, oxen and heifers at the Bethlehem Research Station. The carcass mass of bulls at 12 months was 29 per cent higher than that of heifers and 10 per cent higher than that of oxen. Bulls were graded 25 per cent lower than oxen and 30 per cent lower than heifers but if the present consumer preference for lean rather than fat meat is taken into account, it is evident that the bull's meat will become increasingly important in future.

No differences in carcass mass were found between Hereford, Charolais, Brahman or Simmenthaler/Friesland crosses and pure-bred Frieslands. In view of the outstanding performance of the pure-bred Friesland it is clear that Friesland cows should not just automatically be crossed with beef breed bulls.

Results obtained with creep-fed calves at the Nootgedacht Research Station show that when they are slaughtered at weaning age (210 days) the profit after the deduction of creep feeding costs is R12 and R3 per head for calves that received creep feeding from the age of 3 and 5 months respectively.

However, when such calves are finished until they reach a mass of 450 kg, creep feeding from the age of 3 months has no economic advantages over creep feeding from the age of 5 months. However, the net income from both these treatments was R29 per head higher than from the control group, which received no creep feed.

Results of trials at Dohne showed that it is possible by means of supplementary feeding, to get a beef breed heifer to calve at the age of two years. However, a fairly high feeding level is required to enable a heifer that calves so young to produce sufficient milk and to supply her requirements for growth.

Beef cattle are finished in feeding pens on a limited scale in the Eastern Cape. It was found at Dohne that oxen on *Eragrostis curvula* grazing with a supplement of 3 kg of maize meal a day show a daily mass increase of 1,64 kg. The cost of fertilising the grazing plus the cost of the maize meal supplementation is still considerably lower than the cost of fattening the oxen in a feeding pen.

Supplementation after calving has no effect on fertility if sufficient rested veld is available, but if the summer season has not been favourable and the rested veld is poor, energy supplementation produces a higher calving percentage.

DAIRYING

It was disturbing to note that, despite the good fall during the year under review, milk production fell tremendously. This development again underlined the inherent instability of the primary dairy industry.

For several years the per capita consumption of milk has been dropping annually, although the domestic market for dairy products is expanding more rapidly than in most other parts of the world. The consumer is already spending about R300 million annually on milk and dairy products.

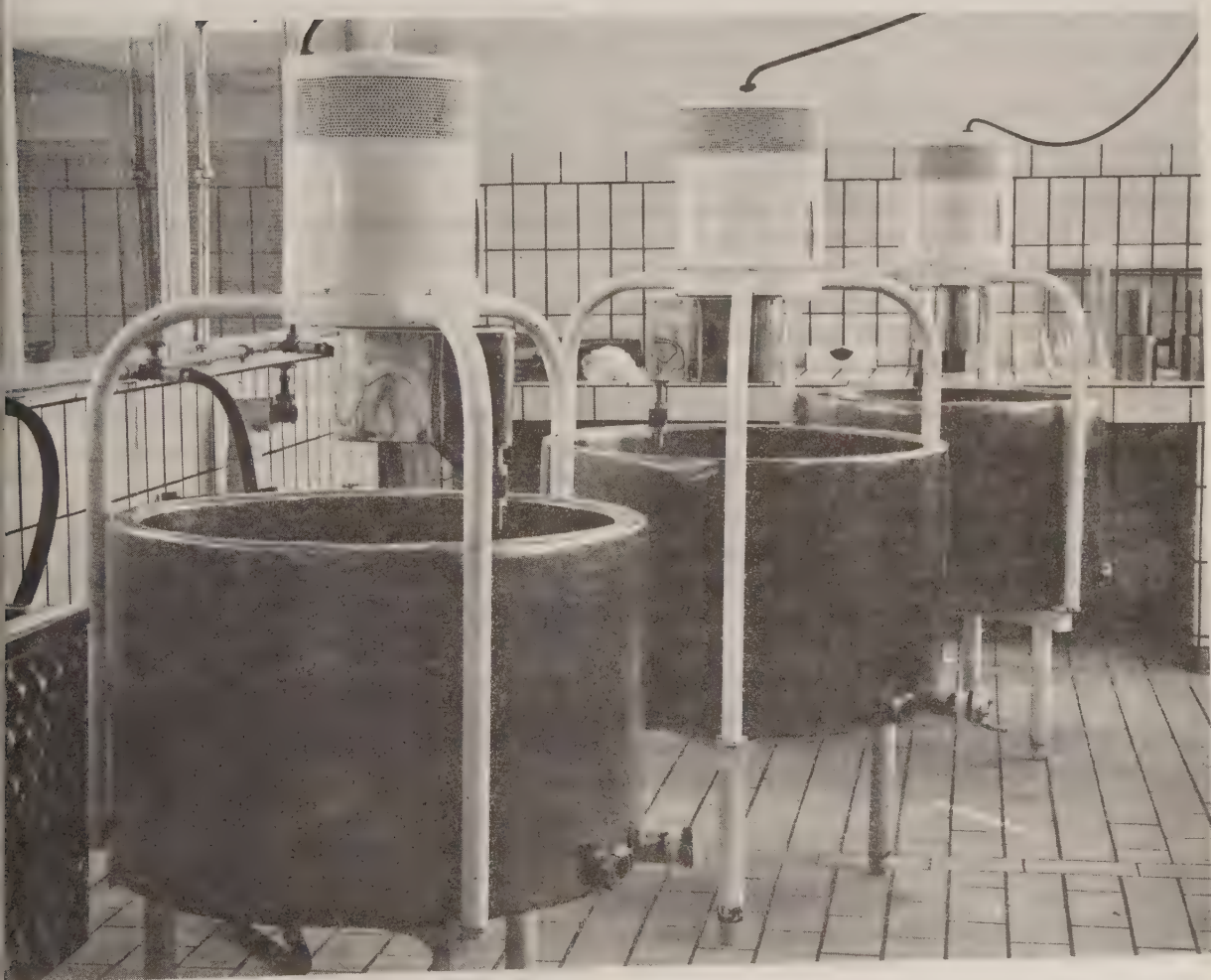
Increased efficiency and more economic milk production depend on the genetic potential and management of the national herd, but the weak link is feeding. Milk production could virtually be doubled overnight with the correct feeding and management.

The Milk Recording Scheme

The chief development in this scheme was the implementation of the owner sampling technique, which largely eliminates the virtually insoluble problems connected with staff and financial pressures. The investigation into the desirability of this technique was continued for three years, after which the recommendations were approved by the Advisory Committee for Milk Recording and Related Matters in South Africa; the technique has been applied officially since February 1974.

During the year under review 412 563 official tests were carried out (an increase of 4 985 over the previous year) on an average of 793 herds a month, with an efficiency percentage of 85%.

The average herd size is still increasing and 5 138 grade heifers were identified for bull analysis.



Small cheese vats at the Animal and Dairy Science Research Institute are used for statistically identical pilot trials in the manufacture of cheese

Production records, herd averages and inter-calving periods for 48 068 cows, and breeding performance figures for 190 dairy breed bulls, were published during the year under review.

Milk

The influence of physical treatment on the incidence of rancidity (free fatty acids) in milk

Faulty pipelines and the general layout of milking machines cause lipolysis, with the consequent development of free fatty acids that give milk a rancid taste. This defect is particularly evident when butter is made from the cream of such milk.

Various systems were investigated, with the object of reducing lipolysis to a minimum. There is a possibility of using the free fatty acid content of milk as a criterion for determining the efficiency of milking machines in this respect.

If milk is separated after pasteurisation the incidence of rancidity may be significantly reduced.

Sample size determination for estimating the hygienic quality of milk

When a scheme for payment for milk on the basis of hygienic quality was introduced the question of representative sampling arose. It became necessary to determine the minimum number of samples to be analysed to obtain a truly representative value for the month's delivery. The relevant studies revealed that this could be achieved with 3 methylene blue tests per month, permitting milk to be divided into quality categories of 6-fold progressive differences in bacterial content.

The formation of free fatty acids in milk products

To make it possible to detect lipolytic activity (rancidity) in milk on receipt at a factory, a screening test (with rhodamine G) is being developed.

At the same time a survey is also being conducted to establish the degree of rancidity in milk received by factories. It was found that more than 30 per cent of milk contained free fatty acids above the acceptable limit.

Butter

The manufacture of salted cultured cream butter (aroma butter)

Suitable techniques for manufacturing a pleasant salted cultured cream butter (aroma butter) were

investigated. Standard procedures were drawn up with regard to the raw product, technological methods, desirable bacteriological cultures, the optimum conditions for the development of acid and flavouring substances, and the organoleptic qualities required of the product.

The necessary standards were also laid down for important properties such as spreadability, keeping quality under ordinary storage conditions, and especially stability with regard to fat oxidation and other lipolytic influences.

The next step is for permission to be granted to selected creameries to manufacture this prestige product under supervision.

Aspects of testing composite cream samples — In the Republic of South Africa the fat content of each individual can of cream supplied to a creamery is tested separately. Because of the number of tests and the cost involved the question arose whether this is necessary or whether the method of testing composite cream samples would not be more practical. By testing 1-day composite cream samples the quantity of butterfat delivered to creamery could be determined with the same accuracy by testing each can separately.

A prolonging of the compositing period can, however, not be recommended.

Determining the presence of free fatty acids in neutralised butter

The free fatty acid content of butterfat is the cause of rancidity in butter and is an important criterion for judging butter objectively. If butter is neutralised to a high pH level (7.5 and higher), salts of the free fatty acids are formed and these are then lost in the water phase.

If such salts are allowed to separate in an acid medium they are taken up into the fat phase and it has been found that optimum dissociation can be obtained with a pH of 6.0 and lower.

This new method, which will serve as a standard analytical method, is being finalised at present.

Determining the presence of chlorinated insecticides in dairy products

This project has so far been confined to butter. BHC was found in all the samples, in concentrations varying from 1 part per million to 8 parts per million. DDT occurred in some samples. Various isomers of this insecticide were obtained with the aid of a mass spectrograph.

During the past year 382 choice butter samples analysed immediately after manufacture and 342 samples were analysed for keeping quality. The samples came from 17 creameries in the Transvaal, the Orange Free State and the Northern and North-Western Cape. The following table shows the percentage of samples which comply with the analytical standards laid down for good quality butter immediately after manufacture and for good keeping quality.

Percentage of samples that comply with the analytical standards laid down for good quality butter with a good keeping quality

Analysis	% of samples of a good quality immediately after manufacture	% of samples with a good keeping quality
Moisture distribution	28,80	—
Percentage moisture	55,76	—
Acidity (pH)	62,57	—
Percentage salt	32,72	—
Peroxide value (oxidation)	6,28	8,45
Rancid value (rancidity)	12,04	8,16
Contaminative organisms	26,18	6,41
Lipolytic organisms	60,47	35,57
Proteolytic organisms	47,12	39,07
Bacteria and moulds	82,98	61,22

Analyses of samples are used as objective criteria for judging the quality of butter. Oxidative and lipolytic defects are chiefly responsible for the poor quality and keeping quality of this butter.

Cheese

The preparation of starter cultures for the manufacture of South African Gouda cheese

A collection of single-strain lactic-acid bacteria was obtained from overseas and 18 cheese starters consisting of combinations of 2 or 3 single-strain isolates were prepared. The activity of these composite starters and their suitability for the manufacture of Gouda cheese were investigated. Ten of these starters produced very promising results.

The preparation and handling of cheese starters in South African cheese factories

The preparation and handling of cheese starter cultures at 38 cheese factories in the Republic and South-West Africa was investigated. The survey shows that there is considerable room for improvement with

regard to the preparation of culture media, general inoculation techniques and control over starter activity.

Study of the propionic acid bacteria in Gouda cheese

The importance of the propionic acid bacteria in the dairy industry is well known. A number of experimental normal Gouda and low fat Gouda cheeses were made with low gas and lipase producing propionic acid bacteria. The favourable results obtained showed that these organisms could be used as secondary flavour producing starter organisms.

It is now possible to select suitable strains for use in starter cultures for the production of Swiss type cheese as well as Gouda and low fat cheeses.

The influence of surface micro-organisms on the quality of film-packed cheese

With film-packed cheese there is sometimes the problem of undesirable bacterial growth taking place on the surface below the film and causing flavour defects and sometimes physical defects as well. In the course of preliminary survey studies of commercial cheeses certain *Betabacterium* species, particularly *Lactobacillus buchneri*, were isolated. They are responsible for gas formation towards the end of ripening.

Salting Gouda cheese

The work on baby Gouda cheese has shown that if calcium chloride is added to brines both moisture loss and salt absorption are increased.

Reclaiming whey proteins to supplement the proteins in cheese

In the manufacture of cheese about 20 per cent of the total protein is lost in the whey. Whey proteins can now be reclaimed through denaturation, centrifugation or ultrafiltration. If the whey proteins are returned to the cheese not only is the yield raised considerably but the biological value of the cheese protein is increased from 75 per cent to 85,3 per cent, which is very important. This makes cheese a far better food than it is at present.

Extension, training and promotion

The results of the dairy products quality improvement service were followed up with recommendations and visits to factories in an attempt to improve the quality of South African dairy products. The campaign was directed chiefly at butter, because of the marketing problems experienced with this product.



The influence of the type of starter on Gouda cheese: Cheese A is made with a starter containing gas-producing bacteria, while cheeses B and C are made with starter without gas-producing bacteria. The starters in B and C were developed by the Animal and Dairy Science Research Institute

On various occasions technical assistance was rendered and recommendations made in the field of technology and laboratory control, and *ad hoc* investigations were carried out in connection with certain defects in other dairy products.

The Institute assisted with the planning of several dairy-produce factories, particularly with regard to the layout and the selection of equipment. Effective technical assistance was rendered with the introduction of a new process which gives fresh milk a shelf life of a month at ordinary air temperatures.

Quality purchases of milk

The purchasing of fresh and industrial milk on a quality basis was accepted in principle by the working group of the Advisory Committee for Dairy Technology and Production.

Feeding

It was shown that the Dohne Research Station that with an average daily production of 21,1 litres 4 per cent fat-corrected milk is maintained over a period of 150 days with Friesland cows.

Trials at Bathurst showed that Jersey cows on a concentrate ration containing 30 per cent of chicken manure yield an average production of 18 litres 4 per cent fat-corrected milk over 120 days.

In order to promote milk production in the Natal Region and place the feeding of dairy cattle on a more economic and scientific basis, a guide, "Feeding Dairy Cattle" was prepared and made available. Special emphasis was placed on the effective supplementation of grazing and other types of roughage.

The recommendations in the guide on the feeding of dairy cows were applied to half the Cedara herd. Considerable savings on the amounts of concentrates were effected, and the milk production per cow for summer period was increased to 55 litres.

The evaluation programme for kikuyu grazing was continued. The digestible proteins were found to vary from 16,7 per cent to 13,3 per cent, and values for total digestible nutrients of 67,25 per cent to 52,3 per cent were found. Grazing management practices had a greater effect on the nutritional value of kikuyu than the time of year.

The calcium content of kikuyu grazing was generally found to be low, viz from 0,13 to 0,19 per cent. The phosphate content, on the other hand, tended to be high, viz from 0,23 to 0,43 per cent. Signs of calcium deficiency were observed in dairy cows where animals did not have access to licks containing calcium phosphate or bonemeal. It is necessary to add feed lime to correct the calcium/phosphate balance when cattle are run on kikuyu grazing.

SHEEP AND WOOL

National Aid Schemes

The National Mutton Sheep Performance and Agency Testing Scheme has shown very good progress during the year under review. At present there are 36 laboratories in terms of the scheme and data from 71 lambs were collected and processed. In the course of operations 13 430 ewes and rams were selected under the scheme and recommendations regarding breeding objectives were made.

Interest in performance testing of woolled sheep is increasing. The number of participants in the scheme at present is 60 and another 21 breeders have applied. Seven courses lasting a week each were offered this year and attended by 125 persons, and 6 day courses were attended by 117 persons. In addition a course in performance testing, on the subject of genetics for the stud farmer, was offered for the first time this year. It was very successful and was attended by 32 persons.

After two officers from the Fleece Testing Centre visited the Winter Rainfall Region, where a number of one week and one day courses were offered at various centres, performance testing is starting to gain ground rapidly there.

Breeder's societies such as the Merino Stud Breeders' Association, the Walrich Breeders' Society, the Johnne Breeders' Society and the Kaffrarian Poenskop Merino Breeders' Society are well aware of the value of

performance testing and encourage their members to participate under the scheme in various ways.

The total number of wool samples analysed during the year under review increased by about 1 000.

Grazing evaluation

During the year under review the grazing evaluation programme of the Animal and Dairy Science Research Institute was started with the establishment of an *in vitro* digestion unit. During the first two months of its existence the unit carried out 462 *in vitro* determinations.

The capacity of the unit is 66 determinations a week at present and next year it will be expanded to handle 197 determinations a week.

Mathematical models for describing growth

A particular mathematical relationship between animals' feed intake and their mass at any particular time has been established. This relationship provides a new prospect of finding a method that will make it possible to draw valid comparisons between breeds in respect of production efficiency.

Body composition of sheep

A great deal of progress has been made with the collection of data on the body composition of sheep. It was proved by means of extremely drastic feeding treatments that it is virtually impossible to change the body composition of ruminants by feeding. For a certain body mass a sheep or cow will have a certain quantity of protein, fat or water in its body, regardless of feeding conditions. However, this does not apply to pigs.

Breed differences in production efficiency

With the aid of the animal gas exchange apparatus at the Animal and Dairy Science Research Institute it was possible to prove that the basal metabolism of fat-tailed sheep does not differ from that of woolled sheep after the correction for mass has been made.

Several studies also showed that such widely differing types of sheep as Karakuls, German Merinos, fat-tailed sheep (Pedi type) and Merinos may be said to eat the same amount, if corrections are made for differences in body mass. However, the production response of the various breeds to a particular feed intake differs considerably.

The palatability of meat depends on the amount, nature and distribution of the connective tissue in the muscle. The more connective tissue present in the muscle and the older that connective tissue, the tougher the meat will be. A trial was conducted with sheep ewes

of a few breeds and Boer goat ewes. Muscle development and connective tissue growth were determined with reference to age in seven identical muscles in the right and left halves of the carcass and the findings were as follows:

- At the age of one month the Dorper lamb was ahead of the other lambs in respect of the average of the muscles of the two halves of the carcass and carcass mass.
- At 4 months the Mutton Merino was ahead of all the other breeds in respect of both qualities and at 18 months the Mutton Merino was still easily retaining its lead.

Feeding

Phosphate supplementation in the form of monosodium phosphate, dicalcium phosphate and bone meal for young growing Merino wethers (two-toothed wethers) over a period of five months showed no advantage in comparison with the control group. The phosphate intake of the control group was about 1 g of

phosphorus per sheep per day and that of the experimental groups about 2,4 g of phosphorus per sheep per day.

Phosphorus balance studies showed that the supplementation of phosphate in the ration only produced increased excretion of phosphorus in the dung. According to these results the supplementation of phosphorus for Merino wethers would appear to have no direct advantages.

The abundant rains in the Free State Region during the past year made a great contribution to veld improvement, a higher feeding level, feed reserves on the veld, roughage production and the production of artificial winter pastures. However, the rains also caused heavy stock losses as a result of virus and bacterial diseases among lambs and young sheep.

The deficiencies of the commonest commercial energy/protein products were revealed by research carried out at Dohne during the past year. It was also found that energy/protein supplements have relatively little value for livestock when the veld has been so



A highly productive Merino ewe of the Grootfontein Merino stud that produced 15 kg of wool and reared a lamb in the same year

ized that only the inferior fraction is available for g. Loss of body mass then increases sharply and only be halted by using bulkier feeds such as silage ay. When the same situation occurs on sweet veld se of high protein energy licks is very undesirable se it leads to over-utilisation and trampling of the

A tilting creep feeder that is equally effective as a feeder for lambs, a self-feeder for sheep and for ing lambs, was designed and thoroughly tested. Feeder, which is the only one of its type, is available sent.

The practical advantages of the feeder are that it is to transport, is very capacious, the feed cannot away or rain wet, blockages when ground feeds are are eliminated by the tilting movement, the status is a self-feeder and the access of ewes and s to a suitable ration in the feeder can be regulated ll, which is especially desirable before the weaning

agement

The chief obstacle to increasing mutton uction is the custom of having a single lambing on. Research at the Bathurst Research Station has n that breeds that are known to have a long ding season can be successfully made to lamb every n to nine months in the coastal areas. This type of ding system naturally requires good feeding itions, which a variety of artificial pastures as the s.

For various practical reasons spring mating is ly practised. Because of the often unfavourable atic conditions at that time of year and the low level sexual activity, conception rates are often poor. ly group results in the Eastern Cape have shown that lity figures as high as 100 per cent in maiden ewes 160 per cent in mature ewes can be achieved in ino sheep by good management prior to mating. It ld appear that greater success is achieved by flushing ry land lucerne than by the feeding of dry feed.

An investigation into the reproduction of riedale ewes in Natal showed that if teasers are used two weeks before the start of the normal covering on sexual activity in the ewes can be stimulated and high degree of synchronisation of oestrus can be ieved. After stimulation with teasers 90 per cent of a up of 314 ewes, were effectively covered within the t three weeks of mating.

Trials with Dormers at Elsenburg aimed at higher roduction by means of three mating seasons in two rs are showing promising results.

A selection trial with Merinos at Tygerhoek indicates that lambs can be successfully selected for wool production as early as weaning age, and the culls can then be marketed at an early age.

Lambs of three sheep breeds were fed on the Highveld from weaning age at 8 weeks until they reached various carcass masses and were then slaughtered. Up to 42 kg of live mass there were no significant differences in the efficiency of feed conversion, except in the case of the Merino, where efficiency dropped after 37 kg. The best carcass grading and the softest meat were found at 42 kg of live mass.

A trial was carried out to determine the effect of flushing and hormone treatments on the average incidence of oestrus and conception, as well as on the period between withdrawal of the swab and the first oestrus and the duration of that oestrus. The ewes were synchronised during the mating season in March 1974 by means of swabs.

Synchronisation was effected very successfully, notwithstanding the feeding level or the dose of PMS (pregnant mare serum). Although feeding did not have much effect on the percentage of pregnancies, the application of PMS raised this percentage from 54,4 per cent to 72,5 per cent. The results showed that feeding and the dose of PMS have an effect on the period that elapses from the withdrawal of the swab to the start of oestrus, especially where artificial insemination is undertaken without individual testing for oestrus.

The effectiveness of shade and the use of sheep blankets in reducing weathering and so ensuring a longer length of undamaged fibre was investigated under field conditions in the Karoo. The weathering of layers underneath the outer tip portion of the wool can largely be prevented by covering the sheep with sheep blankets for three to six months during the hot summer months and providing adequate shade in the camps.

Attempts were made to raise the reproduction rate by feeding lactating Karakul ewes according to their nutritional requirements. Mating was then carried out at each oestrus that occurred during the first 60 days *post partum*. Ewes receiving this treatment were compared with ewes that had not lactated but had received the same ration as lactating ewes and ewes that had not lactated and had been kept on a maintenance ration.

It was found that:

- Oestrus occurred in 70 per cent of the lactating group and 50 per cent of this group were reimpregnated during the first 60 days *post partum*.
- In both the non-lactating groups over 90 per cent of the ewes exhibited oestrus and 60 to 68 per



Fertility: South African Mutton Merino ewes with their twin lambs. The photo was taken at Glen

cent of the two groups became pregnant again during the first 60 days *post partum*.

- The period between parturition and reimpregnation did not differ in the lactating and non-lactating ewes.
- In the lactating ewes reimpregnation occurred at the first *post partum* oestrus in 85 per cent, as against 29 per cent of the non-lactating ewes.
- Sixteen per cent of the non-lactating ewes that received the same ration as the lactating ewes had twins. The Karakul therefore appears to respond favourably to flushing during the active breeding season in that fecundity is increased.
- In a flushing trial during anoestrus it was again impossible to show that flushing increases the incidence of oestrus. However, impregnation in the flushed group was 20,4 per cent higher.

Results obtained with Karakuls at the Kalahari Research Station indicate that good grazing control and management are of the greatest value in raising the lambing percentage. By selecting for high fecundity, the present lambing percentage can be raised still further.

Breeding

In view of the increasing demand for coloured pelts in the international fur trade it was decided to undertake the breeding of white and grey Karakuls.

Good progress has been made with the breeding of recessive white Karakuls from black Karakuls with white brushes and/or blazes. These animals are not subject to sub-lethal factor.

An investigation to determine the effect of weaning age on puberty and growth in Karakul lambs showed that Karakul lambs can be successfully weaned at an early age if they learn to eat creep feed. In this way the extra burden is removed from the ewe and she can sooner regain her physical reserves.

ANGORA GOATS

Grazing conditions in the mohair-producing areas are very favourable at present. Unfortunately the good grass cover has meant that the mohair in many areas is severely infested with impurities, chiefly burr bristles.

At present there are about 900 000 Angora goats in the Republic, 70 per cent of which, or 630 000, are found in the Karoo Region. The tendency is to increase numbers slowly.

Research at Grootfontein has shown that it is possible to distinguish between two types of abortion and that the abortion problem can largely be overcome by correct management practices, especially with regard to feeding and selection.

BOER GOATS

The productivity of improved Boer goats and sheep was determined under controlled selective breeding conditions on sour mixed bushveld (plaat), and the result obtained was a ratio of 1:2. The ewes are served three times every two

Boer goats show higher fecundity than Dorpers, have the disadvantages of a lower rate of conception, higher lamb mortality up to weaning age, lower weaning weight, extremely slow growth and poor carcass grading.

The extremely high production efficiency of the sheep in comparison with Boer goats may be attributed chiefly to the earlier marketability of the lambs and the ewes.

A great deal of research has been done on the captive-bolt stunning of pigs before they are slaughtered, but the stunning of cattle, sheep and goats has not received much attention until an experiment was carried out with Boer goats. One group was placed under halothane anaesthesia so that glycolytic rates in

the muscle sample could be observed and a second group was stunned with a captive-bolt pistol and the rate of *post-mortem* glycolysis observed for five hours after death. Four different muscles were examined for various enzymatic reactions at predetermined *post-mortem* periods.

It was found that a rapid *post-mortem* glycolysis took place in the muscles of the goats stunned with the captive-bolt pistol, but this glycolysis was not sufficient to produce PSW meat (pale, soft and watery meat). The muscles of goats are thought to be less sensitive to reflex nervous stimulation caused by the captive-bolt pistol than the muscles of pigs.

A Boer goat herd is being built up at Bathurst at present. As soon as facilities at the Adelaide experimental plot are adequate the herd will be transferred to Adelaide. Matters relating to feeding and management will be investigated there and the goats will be used to determine the best cattle:goat:sheep ratio.

Trials have been undertaken in order to find a successful method of freezing Boer goat semen. Preliminary results show that motility recovery is

A tilt creep-feeder for sheep developed at the Glen College of Agriculture





Abortion in Angoras remains a serious problem. The photo shows a case of oedematous abortion with advanced oedema

successful in frozen Boer goat semen. A procedure and technique have been laid down for further study and are at present being tested in inseminations carried out in the course of field studies.

PIGS

National Aid Schemes

One of the most important developments during the year under review was the opening of the new testing centres at Irene, Cedara and Elsenburg in April. The response from breeders at all three centres was very good; the Irene testing centre was virtually stampeded by farmers wanting to make use of the facilities. By the end of May all the facilities available were being used to the full. More progeny testing groups were accepted during this period (two months) than were tested at all three centres during the previous year.

Five members resigned from the scheme during the past year. In every case small herds (less than 20 sows) were concerned and the herds were sold. The present membership is 50. Three new applications are under consideration and will be approved shortly.

Only 28 progeny groups completed the test during the year under review. Fourteen groups were tested at the Cedara and Pretoria centres, but no groups were tested at the Elsenburg centre. These groups were tested in the old centres. Towards the end of June 1964 groups had already been received at two of the centres. At that stage no groups had been entered for progeny testing at Elsenburg.

In all 496 applications for boar performance testing were received at the Irene and Elsenburg centres. A large number of applications had to be rejected because of a lack of facilities. The test was completed on 254 boars. Fifty-five per cent of the boars at Irene were bought back by the breeders, and 45 per cent were disqualified on the grounds of poor performance and poor legs and feet. The figures for Elsenburg are 38 per cent and 62 per cent respectively.

Feeding

The determination of protein quality is becoming more and more important in view of the increasing demand for proteins and the limited availability of high-quality protein for feeding the monogastric animal.

Biological techniques where the digestibility of acids is determined by using the chicken-ileum technique are at present being developed.

Modern facilities where biological evaluations will be carried out with rats and other small animals to determine biological values for protein sources are nearing completion.

A trial to determine the protein and energy requirements of the pregnant sow showed that although an increase of from 12 to 16 per cent in the protein content of the ration produced a saving in the quantity of feed required for a specific mass increase, it did not offset the higher feed costs.

A study showed that the use of sunflower oilcake and heated full-fat soya-bean meal instead of wheat meal, and the addition of sugar in creep meals for growing pigs produced no improvement in growth rate or feed conversion.

Meat

Stress can increase the incidence of PSW meat (soft, watery meat) considerably.

A trial was undertaken with two groups of pigs: one group was kept quiet and the other exposed to prolonged anxiety-producing conditions. Two sensitive techniques were used for the investigation, namely an eye test and a muscle of the buttocks.

Fifteen minutes after death the pH values of both muscles were taken and a highly significant difference between the excited and the quiet pigs was observed. Glycolysis was accelerated in the excited pigs as a result of their fright prior to death, although the glycogen was exhausted.

Forty-five minutes after death muscle temperature of both the muscles tested was higher in excited pigs than in quiet pigs. The higher temperatures promote the development of the PSW condition.

Rigor (rigidity) in the excited pigs was very significantly higher than in the quiet pigs; this indicates that the first group underwent a more rapid *rigor mortis* than the group of quiet pigs. A lower pH value may be associated with high rigor values.

There was a significantly higher (3 to 4 per cent) cooking loss in the two muscles (an eye muscle and a muscle of the buttocks) in excited pigs than was the case with quiet pigs.

Experimental results indicate strongly that if pigs are not kept in a quiet and calm atmosphere before slaughtering the effect on the quality of the meat is extremely bad.

The technical drawbacks in processing PSW pork were demonstrated in another trial: PSW hams showed a 6.6 per cent higher cooking loss than normal hams and were also paler in colour than normal hams. Both these marginal values are of economic importance, since if they are taken into account the annual loss of an average ham factory (500 pigs a day) can be estimated at about R10 000.

Promoting production

Artificial insemination for pigs is a practical proposition if it is undertaken by the farmer on the farm. Positive steps have been taken to promote A.I. for pigs on a national basis and a number of pig farmers are using A.I. at present.

It was established in the course of a survey study on pig reproduction that litter size is affected significantly by good management and that the number of litters per sow per year can be radically improved by early weaning. It was established that the administration of sex hormones to immature sows can induce puberty, but that the presence of the boar is required if this puberty is to continue.

The number of present and prospective pig farmers who make use of the extension service provided by the pig research section of the Animal and Dairy Science Research Institute is still increasing. During the past year at least 250 farmers visited the section.

The Winter Rainfall Region took the initiative in establishing a Pig Industry Liaison Committee for its area. The committee consists of experts from various sections of the industry and its aim is to co-ordinate extension by means of close contact with all persons who undertake extension in the industry. Informative publications on problems in the industry will be compiled and distributed to producers regularly.

FOWLS

The general trend in egg production indicates that where egg production is the chief or sole source of income farming units have to become larger in order to compensate for the decreasing income per hen which results from the fact that production costs are rising out of all proportion to the income from eggs.

Because of the surplus of eggs for local consumption the Egg Production Control Act is being more strictly applied at present, not only with regard to expansion but also in the sense that egg producers with over 5 000 hens now require a permit, whereas the number when the Act was introduced was 10 000 hens.

Dressed poultry production is undertaken chiefly by a few big producers. The production of broilers is still

showing sound growth, and turkey production has increased considerably over the past two years.

Fifteen per cent of the imports of private bodies goes to the Department and 3 600 dozen hatching eggs of nine different strains were made available to farmers. In addition, imported material is being improved continually.

In the field of feeding, projects are undertaken to determine the most effective protein levels in the rations for egg and dressed poultry production.

During the year under review random sampling tests for egg and dressed poultry production were started at Glen and Irene. There were 59 participants in the egg production test and 15 in the dressed poultry production test.

Several pure strains are being crossed and the progeny evaluated to find the best combinations for producing good commercial chickens for the production of eggs and meat. Strains in which it is possible to tell the sex of day-old chicks are also being developed. In this way the cost of sexing will be reduced considerably.

Restricted feeding of growing pullets

One of the most interesting aspects of poultry production that is receiving attention at present is the restriction of the amount of feed supplied to growing pullets in order to reduce the body mass of these pullets at point-of-lay.

The results of experiments conducted at Ukulinga indicate that the delay in sexual maturity caused by a feed restriction programme during rearing can be calculated simply by ascertaining the percentage decrease in body mass of the birds on the restriction programme at 20 weeks of age compared with full-fed controls: for every 10 per cent body mass reduction, sexual maturity is delayed by five days. This is true even when birds are restricted to a body mass of 40 per cent below the full-fed controls, in which case the age at 10 per cent production is delayed by 20 days.

Because egg size is a function of age to somatic maturity a delay in sexual maturity improves egg size. Therefore restricted feeding, by delaying sexual maturity, eliminates to a large extent the number of small and pullet-sized eggs that are normally laid by birds fed *ad lib* to point-of-lay. In addition, the number of double-yolked eggs is reduced, which indicates that the restricted birds are physiologically better equipped for egg production.

Peak production is significantly improved when the growth rate of pullets has been restricted during rearing. This high production is maintained for a longer

period than in the case of birds which have been fed *ad lib* from day old. Consequently the yield of eggs (mass X number) is greatly improved if an efficient restriction programme is carried out during the rearing period.

Birds in the trial at Ukulinga were subjected to three levels of restriction (12%, 24% and 36% below the body mass of birds fed *ad lib*) from 3 weeks of age, from 6 weeks of age and from 9 weeks of age. No deleterious effects were noted when this programme was started as early as 3 weeks, and preliminary results indicate that the three starting times yielded equivalent results. Egg consumption, whether the programme was started at 3 or 9 weeks of age, was exactly the same in all cases where the body mass reduction was the same.

DUCKS

The breeding project with Pekin ducks that is being improved according to the Hagedoorn breeding system continues to show that heritability of body mass is high in the case of ducks and that the selection of breeding stock for this characteristic on the basis of individual mass will result in considerable improvement.

An experiment involving the effect of increased supplementation of vitamins A, E and choline, a diet low in these vitamins, on subsequent hatchability of duck eggs showed that supplementation was beneficial in all cases.

The use of artificial light to prolong the laying period of Pekin ducks produced promising results. The control group stopped laying in January under natural conditions, whereas the experimental group continued to the termination of the lighting programme at the end of June.

OSTRICHES

According to a recent census the present ostrich population is 94 527. During the past two years numbers were 69 800 and 85 758.

During the past three years feather production increased from 89 600 kg in 1972 to 118 800 kg in 1973/74, and the number of birds slaughtered during the corresponding period rose from 12 449 to 28 000.

The price of feathers remained steady during the year and even rose, despite the increased offering.

The chief difficulties in ostrich production are management problems. The relatively high chick mortality limits the profitability of the undertaking. The problems identified in the industry include problems

eding and parasite control, and a lack of breeding
is.

lack of facilities has restricted research so far,
e necessary facilities have now largely been
d and the projects planned will be able to get off
und.

he effect of various roughage levels in chick
will be investigated during the first phase. A
project will deal with the effect on lucerne
tion of various grazing systems that include
es, and the project will include an investigation of
feeding methods. With regard to breeding, it has
ecided to build up a closed herd from which
tion data can be collected. The prerequisite here
ompiling of quantitative and qualitative standards
ging various characters.

xtension is not being neglected: An intensive
tion programme has been launched in view of the
l parasite problem. Internal parasites are
sible for a large percentage of chick deaths.
ve preparations to control these parasites are
le.

HORSES

breeding mares in the Percheron stud at the
urg College of Agriculture are restricted to 12,
o stallions are being used at present. Although the

demand for breeding animals at the annual auction was
disappointing, the stud is eliciting a great deal of interest
among local as well as overseas visitors.

Stallions are made available for serving mares
belonging to farmers at a nominal fee and 10 mares were
served at Elsenburg during the year under review.

GAME

According to the latest available data there are 213
farms in the *Transvaal Region*, with a combined area of
over 350 000 ha, where game is run exclusively. On a
further 547 farms, covering about 999 000 ha, game is
found in such large numbers that it is very difficult to
apply veld control effectively. Game-proof fences have
been erected on many of these farms, but at this stage
game is still run with cattle because numbers are still too
low for pure game farming. The trend towards erecting
game-proof fences around cattle farms and converting to
game farming is continuing unabated.

However, farmers are having considerable
difficulty in harvesting, and sometimes even in
marketing, the game, with the result that numbers build
up rapidly and soon exceed the potential of farming
units, which leads to over-utilisation of the grass and
scrub grazing. Moreover, there is no practical method of
moving game from one camp to another, so that it is
impossible to apply any form of rotational grazing. The
result is that severe overgrazing of the veld takes place

Gemsbok in the game camp at the Kalahari Research Station in South West Africa



on the sweeter parts of units, and areas where the grass is sour remain unutilised.

There has been an increase in the purchasing of land by city-dwellers in order to start game farms or for hunting purposes.

Game at the project at Omatjenne was harvested for the first time last year. Thirty-seven buck were harvested from the 500 ha camp; the estimated mass was 3 400 kg. This figure gives a red meat yield of 6,8 kg per ha.

A shipment of $8\frac{1}{2}$ tons of game was consigned to Paris from Walvis Bay. The price for springbuck was

about R1 per kg net and the large game yielded about 75c per kg net.

Sixty buck are expected to be harvested this year, with a possible mass of about 4 500 kg, which would mean a yield of 9 kg per ha. These figures compare well with the yield of 6 kg of beef per ha under the same conditions.

The harvesting problem is solved by harvesting the buck at night with the aid of bright lights. The jugular veins are severed and the buck bled immediately.

Harvesting costs amount to about 20c to 25c per kg, depending on the efficiency of the harvesting process.

7. Veterinary Services

INTRODUCTION

During the year under review there were three outbreaks of foot-and-mouth disease in the Republic. The first outbreak in the Kruger National Park was caused by the S.A.T. I strain of the virus. On 5 farms in the Letaba District and 4 farms in the Pilgrim's Rest District in the Natal Province, S.A.T. I strain of the virus was also isolated. In the third outbreak, the Pilgrim's Rest District, S.A.T. II strain virus caused the disease on 2 farms. In order to protect the rest of the stock-farming areas against possible infection with foot-and-mouth disease, all movements of animals and products were restricted in the threatened area, inspections of stock were intensified, cordons thrown round infected areas, and posts established further to control the movements of humans, animals and products, additional animals were sent to the danger areas, pigs were culled on infected farms, and all cattle, sheep and goats in the danger area were immunised with biologically inactivated S.A.T. I, II and III foot-and-mouth disease vaccine.

Seventeen outbreaks of African swine fever occurred in the proclaimed swine fever area. In all cases the extent of infection was determined, infected and uninfected pigs slaughtered with the payment of compensation, and the carcasses destroyed. Pigsties on infected farms were thoroughly disinfected. There were no further outbreaks of swine fever after March 1974.

In the year under review there were 49 outbreaks of sheep scab. The disease appeared in 6 magisterial districts in the Winter Rainfall Region, 5 in the O.F.S. District, 2 each in Natal and the Eastern Cape and Karoo Regions, and 1 each in the Transvaal and Eastern Transvaal Regions. In KwaZulu three magisterial districts were infected.

There were 13 outbreaks of corridor disease, (*Bacterium lawrencei*), 12 of these in the Natal Region and 1 in the Eastern Transvaal Region.

Altogether 90 herds previously infected with tuberculosis qualified for the issue of the tuberculosis-free certificate during the year under review. Since the bovine tuberculosis eradication scheme was initiated in 1969, tuberculosis-free certificates have been issued to 327 herds that were previously infected and are now free of the disease.

Since 1972, when a start was made, with the annual in-service training of stock inspection personnel, officials have attended the course.

The research programme of the Veterinary Research Institute, Onderstepoort, is chiefly of an applied nature and is based on the stock disease which this country has to contend with.

On account of the excessive rainfall and ideal climatic conditions, insect-borne diseases like bluetongue, horsesickness, Rift Valley fever, Wesselsbron disease and three-day stiff sickness were very prevalent during the late summer and autumn of 1974. Stagnant pools of water created ideal breeding conditions for mosquitoes, which increased to pest proportions with the result that deaths and abortions due to Rift Valley fever and Wesselsbron disease continued into the winter months of 1974 in many parts of the country. Luxuriant growth of grass and the penetration of awns resulted in an increase in the incidence of purulent conditions and abscessation, especially in sheep, and the occurrence of footrot in cattle and sheep increased, on account of the moist conditions. Consequently a considerable proportion of the time of the research workers was occupied by the diagnostic work associated with these.

It is expected that these diseases will continue to be a problem in the following year and the highest priority has therefore been given to the improvement of vaccines against them, particularly bluetongue and horsesickness.

The development of an effective inactivated vaccine against Rift Valley fever and the solution of the technical problems hampering the production of vaccines against three-day stiff sickness and vibriosis in cattle are also receiving serious attention.

Increasing intensification of our animal industry has created the need for vaccines against feedlot diseases, particularly virus infections of the respiratory system of cattle. Research has been conducted on these aspects, and the use of vaccines on an experimental basis has yielded promising results. Research is also being done on the development of prophylactic vaccines against footrot in cattle and sheep, blue udder in ewes and colibacillosis and pasteurellosis in rabbits.

The most important research findings of the past year were that, besides abortion, chlamydia were responsible for a wide variety of pathological conditions like inflammation of the eyes and blindness, arthritis, enteritis and pneumonia in young animals, and that the organisms may also be associated with infertility in bulls. It was also determined that, although chlamydia are the primary cause of pre-natal losses, the vaccine released last year controlled the abortion problem successfully. A

further observation was that flies may play an important role in the transmission of chlamydia.

Research on the transmission of *Parafilaria* infection, the cause of false-bruising in cattle, revealed that this parasite was present in three species of flies from August to February. Evidently the infection is therefore transmitted at this time of the year.

During the past year the record number of 152,5 million doses of 36 different vaccines was issued. One new vaccine, namely that against elephant skin disease, was released. The development of this vaccine is an achievement which will contribute to more economical production of beef.

On 1 July 1973, 153 research projects were registered at this Institute. A further 24 projects were initiated and 20 were finalised, and 33 scientific articles were published. An exceptional honour was bestowed on the Institute by the award of a gold medal by the Associated Scientific and Technical Societies of South Africa to the vaccine research and production team of the Institute. This National Award for 1973 was presented on 21 November in recognition of the outstanding contribution of the team to science and technology.

NOTIFIABLE DISEASES

Foot and Mouth Disease

The outbreak in Rhodesia, north of the Limpopo River, mentioned in the previous report did not result in any outbreaks in the Republic.

During the year under review there were three outbreaks of the disease in the Republic, one in the Kruger National Park and the other two in the Letaba and Pilgrim's Rest Districts.

In order to combat the disease outside the Kruger National Park all movements of animals and products were stopped, inspections were increased, 154 km of cordon was established, with a complement of 10 White and 154 Non-White patrol posts on the cordon.

During the campaigns 275 pigs were slaughtered on infected farms and their carcasses destroyed. An amount of R4 925 was paid to the owners of the pigs as compensation. In the Pilgrim's Rest District 3 bovines and 4 goats were also killed and the carcasses destroyed after the animals had strayed into an infected area. No compensation was paid for these animals.

As a prophylactic measure against foot-and-mouth disease, and also as a control measure, 377 789 cattle, 15 822 sheep and 118 960 goats were immunised against the disease in the stock-farming areas bordering on the

Kruger National Park. In the Eastern Caprivi 40 502 cattle and 1 404 goats were protected against the disease by means of immunisation.

In the Kruger National Park the carcasses of all animals culled are examined for clinical lesions of foot-and-mouth disease before the carcasses are transported to the Skukuza abattoir.

Rabies

A total number of 1 119 specimens were examined for rabies by the Veterinary Research Institute, Onderstepoort, during the past year, of which 362 (26,9%) were positive. South-West Africa accounted for 73 of the latter. The incidence of the disease among the species was as follows:

Meercats (different species)	121
Cattle	98
Dogs	25
Wild cats	16
Domestic cats	12
Jackals	11
Sheep	10
Horses	4
Other animals	5

The increase in positive cases in cattle from 6 during the previous year to 98 during the year under review is chiefly due to the increase in positive cases in the north-western parts of the Transvaal, bordering on Botswana. The Division of Veterinary Services intends to add the Magisterial Districts of Thabazimbi, Rustenburg North, Marico, Mafeking 1 and 2 to the present rabies-proclaimed areas during the coming year. This will mean that the dogs in these districts will be immunised annually against the disease, as is the case at present with dogs in the rabies-proclaimed areas of the province of Natal and parts of the Northern and Eastern Transvaal.

It is usual to inoculate all dogs and cats within a 15 to 25 km radius of all confirmed cases of rabies. During the past year 126 099 dogs and 12 955 cats were immunised.

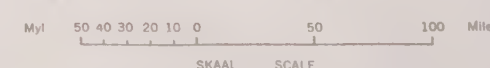
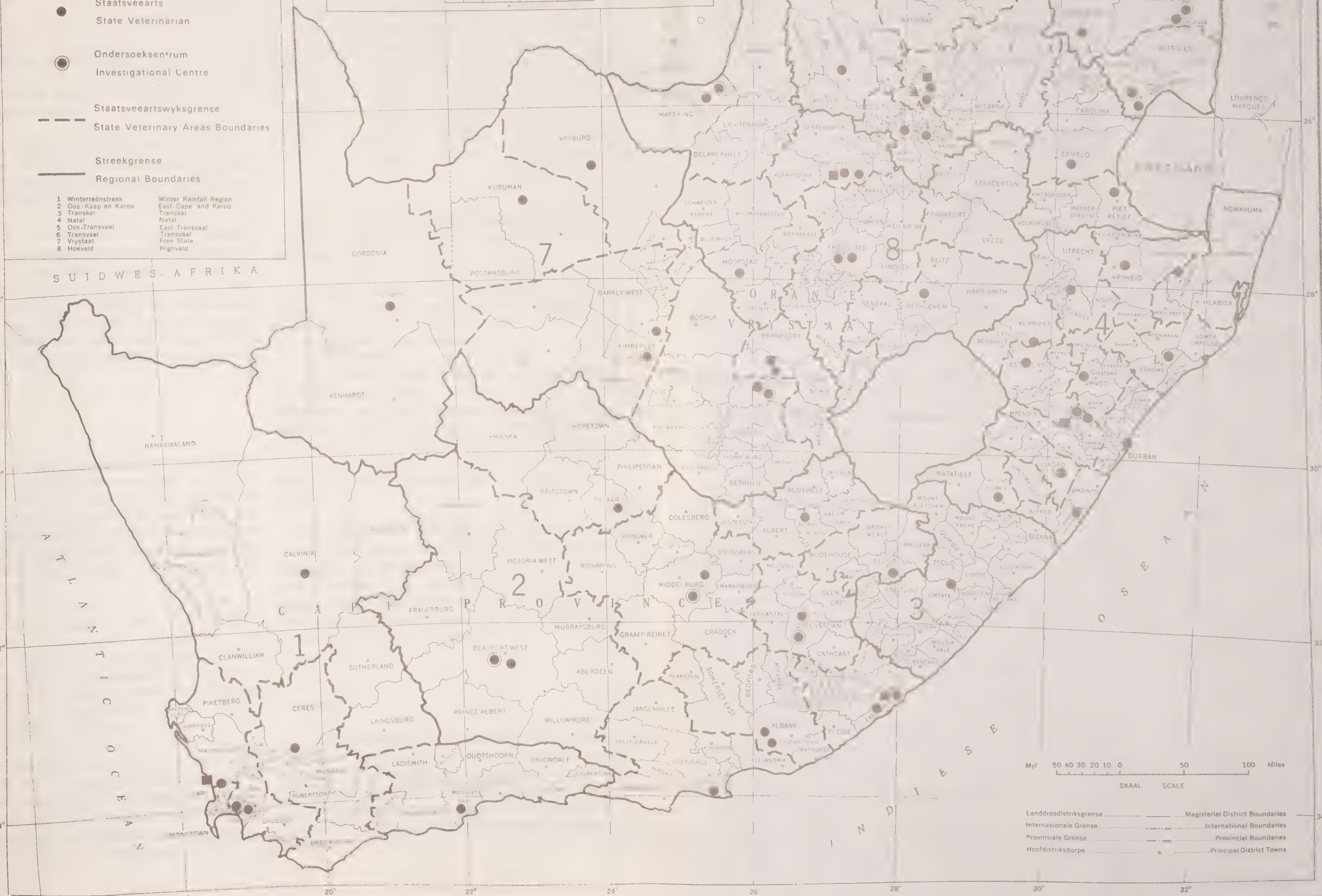
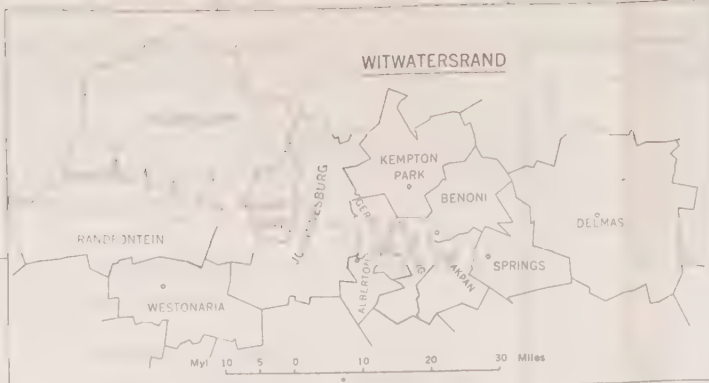
The eradication of meercats in heavily infected areas by means of mobile units in the Highveld and O.F.S. Regions was stopped during the year. Phostox tablets are now put in meercat holes in areas where the infection is confirmed. The unit in the Eastern Transvaal Region assists with the immunisation of dogs and the control of stray dogs in the Venda and Gazankulu Homelands. Before the units were disbanded, the eradication of meercats was undertaken on 85 farms (28 586 ha), and 4 287 colonies and 1 374 individual holes were gassed.

REPUBLIEK VAN SUID-AFRIKA
REPUBLIC SOUTH OF AFRICA

VEEARTSENYKANTORE
VETERINARY OFFICES

- ▲ Direkteur Veeartsenydiens
Director Veterinary Services
- Asst.-Direkteur
Asst. Director
- Staatsveearts
State Veterinarian
- ⊙ Onderzoeksentrum
Investigational Centre
- Staatsveeartswyksgrense
State Veterinary Areas Boundaries
- Streekgrense
Regional Boundaries

- | | |
|---------------------|------------------------|
| 1 Winterreënstreek | Winter Rainfall Region |
| 2 Oos-Kaap en Karoo | East Cape and Karoo |
| 3 Transkei | Transkei |
| 4 Natal | Natal |
| 5 Oos-Transvaal | East Transvaal |
| 6 Transvaal | Transvaal |
| 7 Vrystaat | Free State |
| 8 Hooiveld | Highveld |



- Landroosdistriksgrænse Magisterial District Boundaries
- Internasionale Grænse International Boundaries
- Provinsiale Grænse Provincial Boundaries
- Hoofdistriksdorpe Principal District Towns



During the year there were 8 outbreaks of anthrax in the Republic in which 17 head of cattle died. A total of 2 184 cattle, 11 082 small stock and 78 horses were immunised under the supervision of officials of the Division of Veterinary Services.

In the Kruger National Park one impala and one kudu died of the disease. 89 Roan antelopes were also infected there.

Foot and mouth disease and related diseases

Since 1954 the Republic has been free of East African Foot and Mouth Disease (*Theileria parva*).

In the scheduled areas spleen smears are still a requirement from all cattle that have died. Animals slaughtered at abattoirs where meat inspection is done by qualified meat inspectors are exempt from this ruling.

A total of 307 920 spleen smears were examined by officials of the Division of Veterinary Services during the last year. *Corridor disease* (*T. lawrencei*) occurred in the Eastern Transvaal (1 outbreak) and in the Natal Province (12 outbreaks). Restrictions on the movement of stock and more intensive dipping were the measures adopted to control the outbreaks. *Benign bovine brucellosis* (*T. mutans*) was diagnosed in 12 cases in the last year.

Brucellosis

During the year 2 233 certificates were issued to holders of tuberculosis-free herds. At the end of the period under review there were 3 589 herds taking part in the tuberculosis eradication scheme in comparison with 3 443 herds the previous year. In the course of 391 herd visits to infected herds, 79 653 tuberculin tests were performed with 3 632 positive reactors and 954 suspicious reactors.

During the financial year ended 31 March 1974, 99 positive reactors were slaughtered. The compensation paid to owners for these animals amounted to R438 345. Carcasses that were not condemned as unfit for human consumption were sold for R294 577, in other words 67,2% of the compensation paid was recouped.

Private veterinarians were paid an amount of R77 789 for tests and services rendered on behalf of the State. A further R17 500 for I.N.H. (iso-nicotinic acid hydrazide) used in 35 heavily infected herds and 10 tags brought the total expenditure for the financial year to R633 963 in respect of the scheme.

By the end of the year under review 266 private veterinarians were participating in the scheme.

Since the inception of the scheme on 14 May 1969, 327 previously infected herds have qualified for tuberculosis-free certificates.

A summary of the tests carried out during the year under review is given below:

Test	Number of Herd Tests	Number of Tuberculin Tests	Reactions	
			Positive	Suspicious
Accreditation	2 490	384 128	835	713
Interim	1 100	201 636	1 520	971
Diagnostic	510	35 051	718	207
Import	109	395	—	—
Export	159	2 209	—	—
I.N.H.	35	12 002	472	192
Total	4 403	635 421	3 545	2 083

The percentage reactors, excluding tests on accredited herds, was 1,79% positive and 0,91% suspicious.

Condemnations of pigs at abattoirs are fairly common. One case of avian tuberculosis was diagnosed at Bethlehem. This was found in the last fowl on the premises after the others had died.

The research work at the Veterinary Research Institute, Onderstepoort, on the isolation and identification of a typical mycobacterium from animals and their environment was continued. The biochemical and a.o. characteristics of 48 strains of organism, which were isolated in South Africa, were compared with overseas strains of human and animal origin and found to be identical.

This means that strains which act as pathogens in the U.S.A. and Europe are present as saprophytes in the environment in South Africa. Environmental strains were, however, also pathogenic if injected into domesticated animals. Since soil acts as the reservoir, these organisms cannot be eradicated and we shall have to learn to live with the organism.

Brucellosis

In spite of the fact that many of the inspectorate personnel were assisting with a foot-and-mouth campaign, 569 011 heifers between the ages of 3 and 10 months were nevertheless inoculated against brucellosis under the supervision of or by officials of the Division of Veterinary Services as part of the brucellosis eradication scheme.



An immobilized sheep being infected with bilharzia during an investigation into the disease

In cases where infection was diagnosed, and the State Veterinarian gave written permission for animals older than 10 months to be inoculated, 5 929 animals were inoculated under the supervision of or by officials of the Division of Veterinary Services.

Officials of the Division of Veterinary Services immunised 72 goats and 9 329 sheep against brucellosis.

At state veterinary offices, regional veterinary laboratories, and at the Veterinary Research Institute the following serological tests for brucellosis were performed:

Animal species	Number of Tests	Results	
		Positive	Negative
Cattle	83 804	7 005 (8,4%)	1 822 (2,2%)
Sheep	1 304	53 (4%)	39 (3%)
Goats	79	49 (62%)	7 (8,8%)

The high percentage of positive and suspicious cases amongst the goats is chiefly due to one badly infected flock at Barberton, where 49 out of 60 goats were positive reactors and 7 were suspicious.

Trypanosomiasis

Nagana

No cases of nagana were diagnosed in the Republic of South Africa. A few cases occurred in the Eastern Caprivi on the banks of the Kwando River, where the disease is endemic, tsetse fly coming into the area from islands in the Kwando River Complex and from northern Botswana. The annual spraying campaigns in Mozambique and in the Caprivi tsetse fly complex were amounted as usual.

Owing to the favourable results obtained from previous years' spraying in Rhodesia and Mozambique, activities were concentrated on an area 100 km east of the Rhodesia-Mozambique border and south of the Rio Save.

From 2 June until 28 September spraying teams in Mozambique covered an area of 620 km².

All spraying in Mozambique was done by 4 teams using 5% D.D.T. wettable powder suspension, and in all a total of 275 625 litres was dispensed over the area mentioned.

The contribution by the Republic of South Africa towards this campaign was to supply one senior technician, two officials to supervise the transport of spray teams, four three-ton lorries with drivers, two four-wheel drive vehicles, spare parts for spray pumps, films for aerial photographs, and the fuel for trucks and graders making access roads. South Africa's financial contribution amounted to R15 603.

The results of the campaign were satisfactory, the tsetse fly menace being removed one step further from the borders of the Republic.

Owing to priorities in other areas, Botswana was not in a position to undertake spraying operations in the Kwando complex in 1973. Angola had three spraying teams in the field, but for economic reasons their interest in tsetse control lies further to the north-west of the *Caprivi* complex was undertaken by South Africa.

South Africa's campaign started on 16 July 1973 and ended on 5 October 1973, being mainly concentrated in the Kwando River complex.

In the Western Caprivi security considerations limited entry into the area and the actual area sprayed had to be reduced in size as compared with previous years. However, very few flies were seen in areas that had been sprayed in 1972, indicating that the results of the 1972 spraying operations were satisfactory. Approximately 900 km² of habitat was sprayed, using 7 875 litres of Dieldrin concentrate as a 3,1% emulsion in water.

used in studies on
the diseases are placed on
of cattle where they feed



The total cost of this campaign was R26 695.

In May 1974 the Interterritorial Committee for
the Fly Control met in Pretoria under South African
manship to plan the campaigns for the 1974
flying season. Delegates from South Africa, Rhodesia,
South-West Africa, Botswana, Angola and Mozambique
attended this meeting.

rine

The transmission of dourine from field cases to
receptible horses by coitus has been successfully
achieved at the Veterinary Research Institute. This
has been the first step in an extensive investigation on
chemotherapy of dourine as an alternative method
of control of the disease. Some important new
observations have been made.

It is clear that the infectivity of serologically
positive animals is irregular and becomes increasingly
so as time increases. The causative organism —
Trypanosoma equiperdum — has been demonstrated in

the blood of infected horses for considerably longer than
previously reported, namely up to 14 weeks after
infection. The time interval from an infectious mating to
the development of a positive serological reaction varies
from 23 to 29 days. The classical symptoms, including
the development of plaques, have now all been seen in
the recently infected animals.

During the year 1 786 serum specimens were
examined at Onderstepoort for dourine, of which 60
(3%) were positive. The distribution of cases was:
Transvaal 18, O.F.S. 4, Cape 15, Natal 3, South-West
Africa 5, Botswana 1, Lesotho 14.

Lumpy skin disease

Isolated outbreaks of the Allerton type were
found, in spite of the fact that climatic conditions were
favourable for the appearance of lumpy skin disease.
24 931 cattle were immunised against lumpy skin disease
by officials of the Division of Veterinary Services.

Sheep scab

Outbreaks of sheep scab occurred in 6 of the 7 regions of the Division of Veterinary Services, as well as in kwaZulu. Seventeen magisterial districts with 49 outbreaks in the White area and 3 in kwaZulu were implicated, namely Williston (11 outbreaks), Gordonia (9 outbreaks), Calvinia (6 outbreaks), Malmesbury (5 outbreaks), Belfast and Prieska (3 outbreaks each), Kuruman (2 outbreaks), Tulbagh, Bellville, Fraserburg, Thabazimbi, Vryheid, Dannhauser, Bloemfontein, Jacobsdal, Boshof (1 outbreak each), and in kwaZulu, Nkandla, Ngutu, Madadeni.

A total of 402 571 head of small stock were dipped at least twice, at intervals of 8 to 10 days, on infected and contact farms, under official supervision.

Mange

Sporadic cases were reported amongst horses, sheep, goats and pigs. All cases were easily treated. Special attention is not paid to cases of bovine mange because the value of control measures is doubtful in view of the economic importance of the disease.

Swine fever

European swine fever does not occur in the Republic but for the first time since 1962 African swine fever broke out on 17 farms. In the Gazankulu Homeland, the Magisterial Districts of Giyani and Ritavi were involved, while in Lebowa the Districts of Seshego and Bolobedu were involved, and in the White area the districts concerned were Pietersburg, Letaba, White River and Thabazimbi.

The measures applied to control outbreaks were the immediate determination of the extent of the infection and the slaughter and destruction of infected and contact pigs with payment of compensation. (R10 788 was paid out for 2 268 pigs destroyed.) On infected farms the pigsties were thoroughly disinfected.

At the Veterinary Research Institute, the survey to determine the distribution of African swine fever (ASF) through isolation of the virus from tampanis (*Ornithodoros moubata*) obtained from warthog burrows was continued in collaboration with the Division of Veterinary Services. Approximately 5 000 ticks from 90 burrows were examined and 19% of the burrows were found to be infected. ASF virus was isolated from ticks collected on 2 farms outside the swine fever control area where outbreaks have never occurred.

A non-haemadsorbing strain of ASF virus, which can be grown in monkey kidney cells, was isolated from an outbreak of the disease in the Letaba District. This is

the first successful attempt to grow the virus in a conventional tissue culture system and can be regarded as a break-through in the research work on the disease.

Information gained in the course the above-mentioned survey can serve as a basis for the determination of the swine fever control area boundaries.

Swine erysipelas

During the year under review 14 cases of the disease were reported. In all cases treatment of the pigs with antibiotics and improvement in the hygiene on the affected farm controlled the outbreaks.

Epizootic lymphangitis

No cases were reported this year.

Johne's disease

Only one outbreak, in which one bovine was involved, occurred; this was in the Winter Rainfall Region. The diagnosis was made on post mortem and confirmed at the Regional Veterinary Laboratory, Stellenbosch. The farm concerned, as well as those where the disease has occurred before, is being carefully watched for any further developments.

Infectious laryngotracheitis

Seven outbreaks occurred in the Winter Rainfall Region. The disease was combated by means of the voluntary use of experimental live-virus vaccine produced by the Veterinary Research Institute. 2 487 700 doses of vaccine were used on 18 farms.

Rinderpest

Does not occur in the Republic.

Newcastle disease

Outbreaks of this disease are usually among "backyard poultry", and small poultry farms. Usually these owners do not follow the recommended inoculation programme. The disease also occurred in 3 homelands, namely Venda, Bophuthatswana and the Transkei. 8 outbreaks occurred at Jan Smuts Quarantine Station in imported birds.

Following field observations that the protection induced by the vaccine against Newcastle disease which is produced by growing the Komarov vaccine strain virus in monkey kidney cell cultures was not always satisfactory, the protective effect of the vaccine was compared by the Veterinary Research Institute with that of the conventional vaccine produced in embryonated

Post-mortem examinations on poultry for diagnostic purposes is one of the services provided to the industry by the branch of Veterinary services



eggs. It was found that, although the cell culture vaccine was safer, immunity developed more quickly and lasted longer after administration of the egg vaccine, which is therefore in use once again.

Bacillary white diarrhoea (B.W.D.) and fowl typhoid (F.T.)

There were not outbreaks of B.W.D. this year. There were 8 outbreaks of fowl typhoid.

Fowl cholera

One outbreak of the disease occurred in the Johannesburg veterinary area. The farm was placed under quarantine and an experimental vaccine prepared by the Veterinary Research Institute was used.

Psittacosis

Two cases occurred in Johannesburg. The origin of the infected birds was traced, the original premises and the infected premises were put under quarantine, and the birds treated with antibiotics. Cases also occurred at the Jan Smuts Quarantine Station. All birds that are imported receive treatment with antibiotics and are tested again before being released.

Scrapie

No cases occurred, and the control measures on farms that were previously infected, i.e. regular inspections and permit control in respect of movements from the farm, are still applied.

Equine infectious anaemia

No cases occurred.

Glanders

No cases occurred.

Lungsickness (Infectious bovine pleuro-pneumonia)

No cases occurred in the Republic. All cattle in the Eastern Caprivi were given preventive inoculations against the disease.

NON-NOTIFIABLE DISEASES

BACTERIAL DISEASES

Mastitis

This condition played an economic role once more in the past year, and dairy farmers in particular lost thousands of rands as a result of mastitis. In the Lebowa, Gazankulu and Venda Homelands mastitis is widespread as a result of tick bites on the udders. In many cases this leads to the death of young calves because the mothers' udders are so damaged that they cannot provide the milk to feed their young.

The sensitivity determination for causative organisms in milk samples is done at all regional laboratories and sometimes even at the offices of state veterinarians. In spite of this service and the extension

work as regards prevention and control of mastitis, farmers indiscriminately use mastitis remedies with the result that many of the causative organisms develop a resistance to the remedies.

In the Eastern Cape and Karoo Region 80% of the cases of blue-udder are found to be caused by *Pasteurella haemolytica*. The Onderstepoort *Pasteurella* vaccine gave good results in these cases.

Staphylococcus aureus is still the most important causative organism of mastitis.

Enterotoxaemia

The disease did not assume serious proportions anywhere. Deaths did occur where farmers had not inoculated, or where they dosed or moved sheep to lush green grazing before immunity had a chance to develop.

Quarter evil

Quarter evil occurred in cattle throughout the country. Sheep also died after shearing. *Clostridium septicum* and not *Clostridium chauvoei* was the causative organism in many cases.

The occurrence of the disease is apparently on the increase in the Transvaal Region where mortality in herds rose as high as 5%, and this in spite of the fact that Onderstepoort vaccine provides good protection.

In the homelands, quarter evil runs riot among young cattle. In Venda and Gazankulu the immunisation of cattle against the disease is compulsory, while in Lebowa the compulsory inoculation of cattle is envisaged. 109 705 cattle have been prophylactically inoculated against the disease in the homelands by officials of the various veterinary services.

Botulism

Sporadic cases of the disease occurred. In the Natal and O.F.S. Regions cases occurred where cattle in feedlots were fed rotten fowl manure. In the Winter Rainfall Region cases were found where ostriches were fed ground bonemeal from bones picked up in the veld. Normally a number of cases occur in Bushmanland as a result of mineral deficiencies in the winter and grazing that gives rise to pica. During the past year the cases have been noticeably less frequent because, owing to good rains, the grass remained green.

Infected lucerne hay was responsible for an outbreak in the Fauresmith State Veterinarian's area, while in the Bloemfontein area 6 cattle died after they were in contact with a rotting sheep carcass in a hospital camp. The vaccine against botulism is very effective.

Research at the Veterinary Research Institute of the improvement of the vaccine by the use of an oil emulsion vaccine instead of the conventional vaccine was continued and excellent results have been obtained. The ultimate aim is to produce a combined oil emulsion vaccine against botulism and quarter evil for use in cattle and considerable progress has been made with these experiments.

Corynebacteriosis

This disease occurred throughout the country, caused problems in feedlots in the O.F.S. and Eastern Transvaal Regions. The good rains in the drier parts of the country caused more abscesses in animals as a result of *Aristida* spp. seeds than in normal years.

The condition can be effectively controlled with the Onderstepoort vaccine if the latter is properly used.

Pasteurellosis

This disease has remained a problem throughout the country. The more intensive type of farming is more exposed to this disease. Various cases occurred among sheep, calves and rabbits in the Winter Rainfall Region. In Worcester it caused mortality in poorly ventilated pigsties.

Various cases of mastitis where *Pasteurella* was the causative organism were encountered, mostly in sheep. It appears to be assuming added importance in the Rustenburg State Veterinarian's area.

In all cases the correct use of Onderstepoort vaccine has the desired effect.

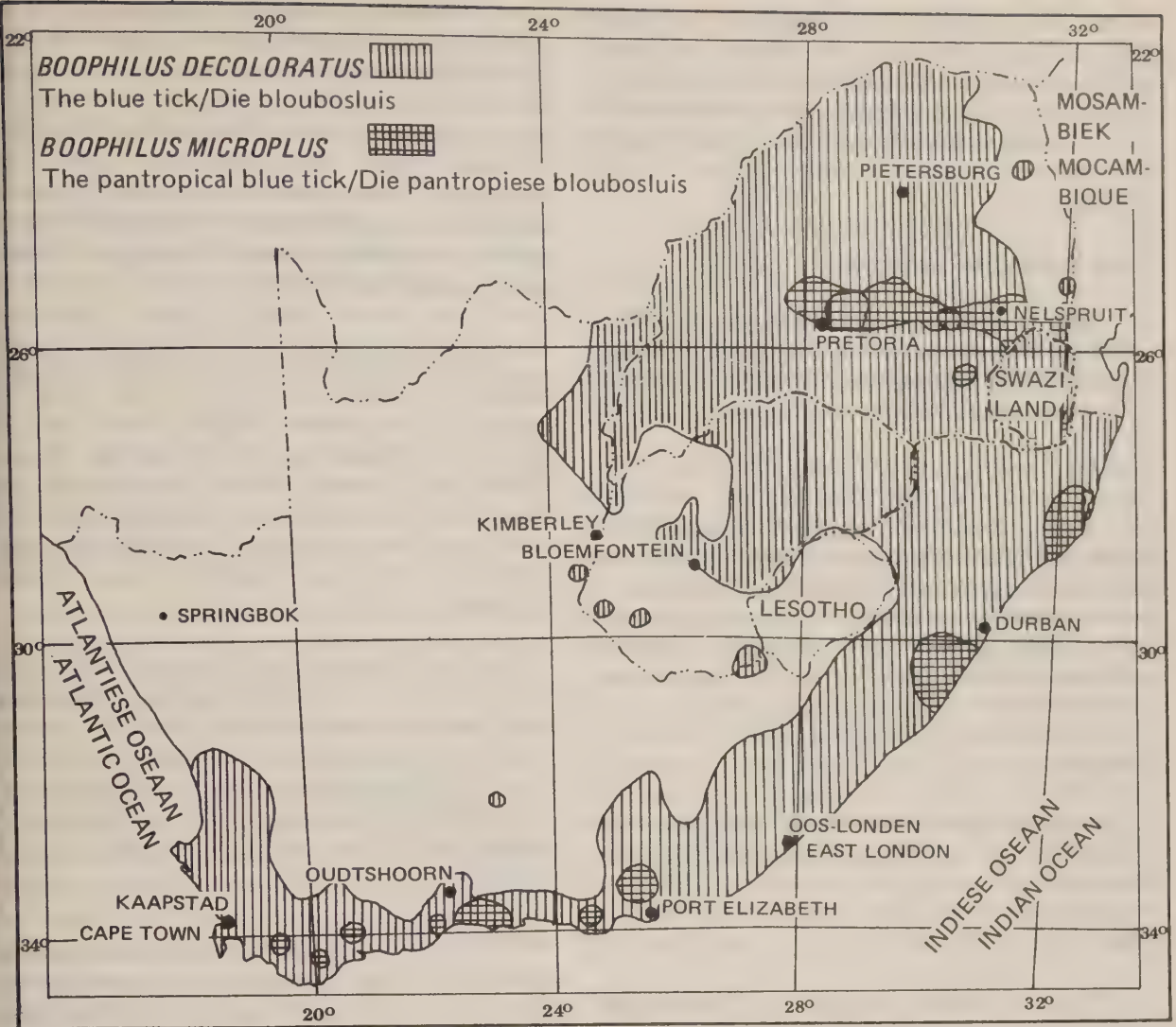
Tetanus

Cases of the disease were diagnosed in all regions, mostly in young lambs where the rubber ring is used for castration or the docking of tails. Cases also came to light after shearing of sheep.

The use of Onderstepoort vaccine gives good results.

Colibacillosis

Escherichia coli once again caused heavy losses among calves, lambs and piglets. In poultry it also played a significant role, especially in the Winter Rainfall Region. The Regional Veterinary Laboratory at Stellenbosch prepared various isolates from strains that are not included in the normal vaccine, these strains coming from farms where *E. coli* caused perinatal mortality. Test vaccines made from these strains and prepared at Onderstepoort gave good results. In Natal, especially in the Ixopo State Veterinarian's area, marked losses in calves occurred as a result of the disease.



Map showing the distribution of the blue tick *Boophilus decoloratus* and the pantropical blue tick *B. microplus* in South Africa

The inactivated polyvalent colibacillosis vaccine for injection of pregnant cows and ewes to protect their progeny was improved at the Veterinary Research Institute, by removing two strains that are very rare and replacing them with two strains that were commonly associated with the disease encountered in calves and lambs in this country.

Owing to the expansion of the rabbit industry in South Africa, many more cases of colibacillosis amongst rabbits were reported. An experimental inactivated polyvalent vaccine has been prepared from 10 of the most common serotypes affecting rabbits. The protective value of this vaccine is being assessed on several farms on an experimental basis.

Better management and hygiene, coupled with the use of the vaccines, gave outstanding results.

Leptospirosis

Only isolated cases were found in the Winter Rainfall, Highveld and O.F.S. Regions.

Vibronic dysentery of pigs

This disease appears to be of importance in the Winter Rainfall Region only. It seems as if the antibiotic resistance of the organism is on the increase, yet extension work and help from the Regional Veterinary Laboratory, Stellenbosch, has helped to reduce losses markedly.

Pseudomonas infection

This organism played a causative role in mastitis in the Highveld and Winter Rainfall Regions. In the O.F.S.

Region the organism was responsible for mid-ear abscessation in sheep. In the George and Knysna Districts it appears as if the organism has developed a resistance to all remedies and mortality results. In the Eastern Cape and Karoo Region the organism, together with wet weather, caused a bluish-green discoloration of the wool.

Actinobacillosis and Actinomycosis

These diseases occur sporadically. Actinobacillosis was found in pigs for the first time in the Winter Rainfall Region. Cases of actinomycosis were found in impala in the southern part of the Kruger National Park.

Footrot

Footrot caused by *Sphaerophorus necrophorus* led to major problems in the O.F.S. Region this year as a result of exceptional rain. Thousands of sheep died or were slaughtered because the treatment and care of the large numbers affected were unpractical in the wet conditions. In the Transvaal Region the condition also caused problems.

Strangles

Sporadic cases of the disease occurred in the Transkei, but no cases were reported in the rest of the Republic.

Lumpy wool

This condition, caused by the fungus *Dermatophilus dermatonomus* and aggravated by the wet conditions, caused problems in sheep, especially lambs in the O.F.S. and Eastern Cape and Karoo Regions.

PROTOZOAL DISEASES

Babesiosis

Redwater in cattle caused major problems in the whole country this year, except in the O.F.S. Region. The favourable weather conditions led to more ticks and therefore more redwater. In the O.F.S. Region there was an increase in the number of cases in Vryburg. In the coastal areas of the Winter Rainfall and Eastern Cape and Karoo Regions the disease was responsible for a high mortality. In Natal the disease remains a problem in the Eshowe State Veterinarian's area, and in the Ixopo State Veterinarian's area the number of cases is on the increase. In the Eastern Transvaal Region there was a particular increase in the cerebral form of the disease in the Lydenburg and Barberton State Veterinarian areas. It seems that the disease does not play such an important role in the homelands, possibly as a result of less tick control and thus higher premunity among homeland stock.

The research work on the improvement of the redwater vaccine was continued at the Veterinary Research Institute. A minimum dose of 100 000 infected red blood cells was found to be necessary for the *Babesia bovis* vaccine strain to be invariably infective immediately after the blood was drawn. The pathogenicity is not influenced by lowering the dose but the prepatent period is indirectly proportional to the number of parasites injected. The longest prepatent period recorded was 28 days.

The vaccine strain of *B. bovis*, which has been passaged artificially for 20 years, was much less pathogenic than newly isolated strains, but the immunity it induced was less satisfactory. A good immunity was, however, obtained by vaccination with the vaccine strain followed by infection with a field strain. Another important observation is that the vaccine strain of *B. bovis* is not infective for ticks (*Boophilus microplus*).

In contradistinction to the situation with *B. bovis* the vaccine strain of *Babesia bigemina* was sometimes highly pathogenic and sometimes caused fatal reactions in non-splenectomised cattle. The degree of protection induced by *B. bigemina* also varied. It is self-evident that the possibility of using more than one strain of *B. bigemina* and *B. bovis* in the vaccine will have to be investigated.

All efforts to transmit *B. bovis* with *Boophilus decoloratus* (the blue tick) have failed hitherto. This tick transmits *B. bigemina* quite readily and is widespread in S.A. It would appear that the distribution of *B. microplus* (the pantropical blue tick), which transmits both kinds of redwater parasites, is more limited. Studies on the distribution of this important tick are being continued.

The research work on the life-cycle of *B. bovis* and *B. microplus* is virtually complete. Important findings are that the larval stage of the one host tick transmits the infection approximately 3 days after attachment and then loses the infection to become reinfected in the adult stage, from the same animal it infected originally in some cases. Similar studies on the life-cycle of *B. bigemina* showed that about 9% of *B. microplus* females do not lose their infection when they feed. It was also proved that one and the same strain of *B. microplus* is susceptible to infection with both species of the redwater parasite.

Biliary fever in dogs once again occurred throughout the country.

Cases of biliary fever in cats occurred in Mosses Bay and in the vicinity of Port St. Johns, where it remains a problem.

Isolated cases of *biliary fever in horses* were encountered. In the Pretoria State Veterinarian's area the farmer lost 50 donkeys as a result of the disease.

Horsesickness (Anaplasmosis)

Once again the disease was encountered throughout the country, but caused fewer problems than bluetongue. There was an increase in deaths as a result of this disease, however, in the Louis Trichardt State Veterinarian's area. In the Mossel Bay State Veterinarian's area the disease remains a problem. In the Karoo lands the disease did not seem to play an important role.

The improved Onderstepoort vaccine gives good results.

Elephant skin disease (Besnoitiosis)

This disease only caused problems in the State Veterinarian areas of Louis Trichardt, Potgietersrus and Swartburg. There was no spread of the disease outside the enzootic areas.

The research work on the development of a live vaccine against the disease has been completed at the Veterinary Research Institute. In the laboratory investigations it was observed that cattle which had been immunised 2½ years previously with 100 000 organisms still showed a satisfactory protection against experimental infection with the disease. In field trials the same dose of vaccine protected 100% of the cattle against the clinical form of the disease for at least 2 years (the endpoint has not yet been determined), whereas 87,5% and 74,6% were protected against subclinical infection for 1 and 2 years respectively. In view of these very satisfactory results the vaccine was released from 18 February 1974.

Coccidiosis

Cases occurred throughout the country in cattle, calves, sheep, lambs, kids, poultry and rabbits. Most of the outbreaks occurred in feedlots and on pastures.

VIRUS DISEASES

Bluetongue

As a result of the very wet summer and autumn there were more cases than normal throughout the country.

In the O.F.S. Region, especially, farmers suffered great losses, losing lambs as well as adult sheep. The disease made its appearance earlier than normal, and many farmers had neglected to inoculate early, or had not inoculated at all, with the result that they lost a lot of sheep. There were outbreaks amongst cattle showing typical symptoms of the disease and even dying from it.

A new serological test was developed recently at the Veterinary Research Institute for the demonstration of antibodies to bluetongue virus. For this purpose the virus is adsorbed to sheep red cells. If serum containing antibodies to bluetongue virus is added to this system in the presence of complement, lysis of the treated cells occurs. This test will now be used for basic studies on the identification of individual cells which synthesise bluetongue virus.

Horsesickness

Once again the abnormally high rainfall was partly responsible for more horsesickness cases than in previous years. The disease even occurred in places where it was hitherto unknown in the Winter Rainfall Region.



Basic studies are conducted at Onderstepoort on the digestive process in the fore-stomach of ruminants

A rare type of horsesickness virus, against which the Onderstepoort vaccine offers no protection, caused extensive losses among horses in the North-Eastern Transvaal during the past summer. By using a sophisticated technique known as the plaque selection technique, by means of which non-pathogenic virus strains may be selected on the basis of the size of the plaques they cause in cell cultures, a very effective special vaccine was manufactured within a short space of time at the Veterinary Research Institute and the outbreak was controlled satisfactorily.

Heartwater

The disease took its normal toll in the eastern Transvaal, Natal, and Eastern Cape and Karoo Regions, as well as in the State Veterinarian areas of Rustenburg, Pretoria, Piet Retief, Mossel Bay and the Marico District. For the first time cases were encountered at Umtata in the Transkei.

In the Eastern Transvaal Region it appears as though the causative organism *Cowdria ruminantium* is developing an increasing degree of resistance to the general remedies.

Ephemeral fever

In the Eastern Transvaal, Transvaal, O.F.S. and Natal Regions this disease assumed tremendous proportions. In dairy herds especially the morbidity was up to 95% in some cases, with young calves also being affected. The course of the disease was longer than normal, in some cases animals remained down for 3 weeks, while in others they died of complications. The lowered milk production in affected animals was an added economic loss to the farmer.

Rift valley fever and Wesselsbron disease

Outbreaks of these diseases occurred in all regions except the Eastern Transvaal, Transvaal and Winter Rainfall Regions. In Natal cases were confirmed to the Eshowe State Veterinarian's area. In the State Veterinarian areas of Kimberley, Bloemfontein and Fauresmith the diseases assumed serious proportions. After bluetongue had taken its toll, these diseases broke out with 95% mortality in young lambs. Adult sheep aborted, and in some cases died. Towards the end of the year under review cattle had begun to abort with some mortality. These diseases were exceptionally severe in the Eastern Cape and Karoo Regions.

The existing live vaccine against Rift Valley fever is not suitable for use in pregnant ewes because it causes abortion. Moreover, it is ineffective in cattle. A live attenuated vaccine which gave a satisfactory antibody response, was tested in cattle during the past year by the veterinary Research Institute. Two inactivated vaccines,

which respectively contained oil and aluminium hydroxide as adjuvants, are still being tested. The antibody response was slightly less satisfactory than that evoked by live vaccine, but pregnant ewes showed no deleterious effects. The immunity of the vaccinated animals against infection must still be determined.

Snotsiekte (Bovine Malignant Catarrh)

Cases of this disease were found in the State Veterinarian areas of Middelburg (Cape), Rustenburg, Eshowe and Lydenburg. In the last-mentioned 3 areas there was contact with gnu.

Jaagsiekte

The disease took its normal toll in Griqualand East. Cases also occurred in the Cathcart, Bethlehem, Potchefstroom, Kimberley and Vryheid Districts, and one case occurred in the Winter Rainfall Region.

Jaagsiekte is a lung cancer of sheep which is widespread. Several workers have produced the disease experimentally by subinoculation of affected lung tissue and filtrates thereof. It therefore appears as if the disease is infectious and probably caused by a virus. Hitherto it has not, however, been possible to isolate a virus and to reproduce the disease experimentally. Cell cultures were prepared from the lungs of 5 clinical cases of jaagsiekte during the past year and after considerable difficulties were overcome, jaagsiekte cancer cells were grown successfully for the first time in vitro at the Veterinary Research Institute.

Apart from contaminants such as mycoplasmas, 2 viruses have hitherto been isolated from jaagsiekte lungs — one a herpesvirus type, the other unidentified as yet. Methods are now being developed to grow these viruses to provide material for biological tests to determine whether there is any association between the viruses and the disease.

Infectious ophthalmia

This condition once again played an important role in the O.F.S. and Highveld Regions. A case was found where *Chlamydia* was the causative organism.

Orf

Outbreaks of the disease occurred in the Winter Rainfall, Eastern Cape and Karoo, O.F.S., and Highveld Regions. However, vaccines prepared at State Veterinarian offices limited losses from the disease.

Mucosal disease

Eleven cases of this disease were diagnosed in the Grahamstown and Bethlehem State Veterinarian areas.

rus diseases of cattle feedlots

The virus diseases of feedlots of cattle received particular attention at the Veterinary Research Institute during the past year. Serological studies conducted on the feedlot showed that nearly all the animals that were introduced into the feedlot were susceptible to infection with infectious bovine rhinotracheitis (IBR) and influenza 3 (P/3), whereas the majority were immune to mucosal disease and adenovirus 3 infection. Only a few clinical cases of IBR and P/3 occurred in the feedlot and the viruses concerned could be isolated from such animals. A combined inactivated vaccine, containing aluminium phosphate as adjuvant, was prepared against the two virus diseases and tested in a feedlot. The vaccine appears to be very promising on the basis of purely clinical observations, but supportive serological work still needs to be conducted.

INFERTILITY AND VENEREAL DISEASES

General

The A.I. and Reproduction Section of the Division of Veterinary Services examined 45 herds with breeding problems. The Regional Veterinary Laboratories at Stellenbosch and Allerton both did analyses on trace elements in blood and organ samples in an attempt to identify farmers' breeding problems where malnutrition was a predisposing cause.

Vibriosis

Particular attention was paid to this condition during the past year at the Veterinary Research Institute. Approximately 5 000 examinations were carried out on sheath washings from bulls and on specimens of vaginal mucus and cervical biopsy material from sexually mature heifers and cows. From the results it was evident that approximately 10% of the bulls and 3% of the female animals were infected with *Vibrio fetus intestinalis* Serotype OI. The infection is present in both milk and beef breeds throughout South Africa.

The research work on the development of an inactivated vaccine against vibriosis was continued. The vaccine was tested in 10 infected herds and found to raise the calving percentage by an average of 35%. The emulsifying agent which was used was, however, unsatisfactory because it caused the development of a large swelling at the inoculation site.

The effectivity of 2 more emulsifying agents was tested. In both instances the swellings were insignificant but the immunity which was induced was unsatisfactory. The technical problems associated with mass production of the vaccine have recently been largely solved by the successful cultivation of the vaccine in a fluid medium. The concentration of the vaccine could therefore be

increased and the volume reduced. This vaccine did elicit the development of unacceptable swellings and is now being tested on a large scale in infected herds.

Trichomoniasis

Trichomonas foetus infection was found in 18 herds examined by the A.I. and Reproduction Section of the Division of Veterinary Services. In 11 cases there was simultaneous infection with *Vibrio fetus intestinalis*. The Section treated experimental bulls against the disease, and 51 bulls in 17 herds were treated. The results obtained were promising, one particular method being tested on 17 bulls after which all 17 bulls were tested with negative results. Research in this connection is continuing.

Sheath washings were examined at the Veterinary Research Institute from 1 907 bulls and 103 were found to be infected with *Trichomonas foetus*. Once again both beef and dairy breeds were involved. Mixed infections of *T. foetus* and *V. fetus* were present in 31 cases. The clinical pictures of trichomoniasis and vibriosis in female animals are so similar that a final diagnosis can only be made by identification of the causative organism(s).

Chlamydiosis

The disease occurred throughout the Republic in sheep, cattle, horses and rabbits. In the O.F.S. Region there were fewer abortions than in previous years, but the lambs pined and died. In the Bloemfontein State Veterinarian's area there were up to 80% abortions in dairy herds. In the Winter Rainfall Region the disease played a role, especially in the State Veterinarian areas of Calvinia, Mossel Bay and Swellendam. Up to 70% abortions occurred in sheep flocks. Weaned rabbits had a mortality figure of up to 80% in the Region. Affected rabbits developed a diarrhoea with loss of condition. In horses there were abortions, brain and spinal cord lesions, and erosions in the joints. The Regional Veterinary Laboratory at Stellenbosch isolated the organism from pigs, game, dogs, cats, birds and guinea-pigs.

The Onderstepoort vaccine for sheep gives good results.

Actinobacillus seminis

This organism added to the sheep breeding problems in the Fauresmith and Upington State Veterinarian areas. The Regional Veterinary Laboratory at Middelburg has found that the infection is wide-spread amongst pedigree rams, with resultant infertility.

Mycoplasma infections

Research at the Veterinary Research Institute showed that the immunofluorescent technique was particularly suitable for the identification of *Mycoplasma* species isolated from cattle, sheep and poultry. The technique was used to classify the approximately 1 000 *Mycoplasma* strains isolated from 1 907 sheath washings of bulls. Three different *Mycoplasma* species were identified and they occurred as pure or mixed infections. Of these, *Mycoplasma bovis* in particular, in association with mycoplasmas provisionally classified as *T-mycoplasmas*, were isolated from bulls with clinically detectable abnormalities of the reproductive system.

Mycoplasmas could also be isolated from the lungs of calves and sheep, the semen of sheep, the conjunctiva of sheep, a bull with conjunctivitis, and the joints of impala with arthritis.

Studies on the cause of the "Epivag" syndrome of cattle

Bulls with typical epididymitis were examined thoroughly at the Veterinary Research Institute for pathogenic organisms. *Chlamydia*, *Mycoplasma bovis* and a *T-mycoplasma* could be isolated from the semen. Though the bulls are serologically positive for IPV, the virus could hitherto not be isolated from the semen. *Chlamydia* could also be isolated from their faeces and *M. bovis* from the eye of one of the bulls.

Some heifers which were served by the bulls developed a pronounced vaginitis shortly after service. *M. bovis* was isolated from the accumulated pus and both *M. bovis* and *T-mycoplasmas* were cultured from cervical biopsies. The heifers have now been served by healthy bulls in an attempt to transmit the infections to them and to determine whether they will develop typical symptoms of "Epivag".

Viruses and infertility in pigs

A serological survey for infection with parvovirus infection was conducted by the Veterinary Research Institute on 176 sera which originated from 35 piggeries in S.A. The results showed that 87% of the specimens originating from 91% of the farms were positive. Sera from Rhodesia revealed that 39% of the pigs and 52% of the farms were infected. The virus is obviously highly infective, spreading rapidly through the entire pig population on infected farms. Two parvovirus strains have recently been isolated from piggeries with infertility problems in the Transvaal.

An investigation on infectious causes of perinatal deaths

The comprehensive country-wide investigation of infectious causes of perinatal losses in cattle and sheep mentioned in the previous report, was continued by the Veterinary Research Institute.

(i) Cattle

This investigation showed that *Chlamydia psittaci* (the cause of enzootic abortion in sheep), was also the main cause of pre-natal losses, i.e. abortions, in cattle. The organisms could be isolated from specimens of 22 (60%) of the 367 outbreaks of abortion that were investigated. Brucellosis was responsible for 30 (8%) of the outbreaks, whereas *Brucella abortus* as well as *Chlamydia* could be demonstrated in 21 (6%). In the case of neonatal deaths (shortly after birth) in particular, *Chlamydia* was encountered in association with other pathogenic organisms like *Escherichia coli*, *Salmonella dublin*, *Pasteurella* and *Corynebacterium pyogenes*.

Vibrio fetus intestinalis (Serotype OI) was isolated from 8 bovine foetuses whereas investigations for *Toxoplasma*, *Listeria*, *Leptospira*, *Mycoplasma*, *Hemophilus* and fungus infections were consistently negative. As in previous years, serological investigations however, indicate that *Leptospira pomona* must be responsible for abortions.

In 20 cases of abortion it was possible to thoroughly investigate the possibility of a virus being responsible. Bluetongue virus could be isolated in 5 cases and mucosal disease virus in one case as probable causes. Rift Valley fever and Wesselsbron virus were respectively isolated from the organs of two calves.

(ii) Sheep

During the past year 197 sheep foetuses, still-born lambs and lambs that died shortly after birth were examined. From this study it was clear that use of the vaccine against enzootic abortion had brought the disease under control, as was forecast in last year's report. *Chlamydia* could be isolated from foetal tissues originating from vaccinated sheep in only a few instances. In unvaccinated animals, however, these organisms could be isolated from more than 50% of the specimens obtained from lamb mortalities, sheep with arthritis and ewes with lung conditions.

Vibrio fetus intestinalis as well as *Chlamydia* were isolated from three outbreaks of perinatal mortality which occurred within a few weeks of the importation of pregnant ewes.

Severe outbreaks of Rift Valley fever and, to a lesser extent, Wesselsbron disease, occurred as a result of

good rains. The disease were particularly prevalent in Orange Free State, North-Western Cape, North-Western Transvaal and South-West Africa. Abortions were uncommon, losses being confined to the first 4 weeks after birth.

Game

Chlamydia were isolated from various antelopes, an eland, a gemsbok, a steenbok and an Indian black buck foetus.

DISEASES OF CALVES

White scours

Escherichia coli infection has, as in the past, caused serious losses throughout the Republic. Poor management and poor hygiene increase the occurrence of the disease. Inoculation of pregnant cows with Onderstepoort vaccine in addition to improved management and hygiene gives outstanding results.

The Regional Veterinary Laboratory at Stellenbosch has done much to limit this important disease in the Winter Rainfall Region. Experimental vaccines, from strains of the organism isolated in the laboratory, are used to good effect in conjunction with the Onderstepoort vaccine. These strains are not included in the Onderstepoort vaccine.

E. coli occurred in the Highveld Region in sheep at Bethlehem. In the Winter Rainfall Region it also caused problems in rabbits, pigs and poultry.

Paratyphoid

Isolated cases occurred in all regions except in Natal, where the disease is a problem even under intensive farming conditions. Farmers use the available vaccine and obtain good results with it.

The present paratyphoid vaccine issued by Onderstepoort is a live attenuated one. For various reasons this vaccine is not always very satisfactory and the whole question of immunisation against the disease is being reinvestigated at present. Preliminary research has been conducted in mice. Very satisfactory results have been obtained with an inactivated vaccine prepared from a virulent strain of *Salmonella typhimurium*. Live vaccines only gave satisfactory protection if they were early virulent, i.e. if they were dangerous to the vaccinated animals. These investigations have now been extended to calves.

Accidiosis

Isolated cases occurred throughout the country. In Natal, there was a serious outbreak in the Underberg

District. Under intensive farming conditions the disease caused problems in the Highveld and Eastern Transvaal Regions, mostly when calves were weaned and then moved to other grazing. Treatment can be successfully applied and outbreaks controlled.

Calf diphtheria

Isolated cases of the disease were diagnosed in the Highveld, Winter Rainfall and Eastern Cape Regions.

Sweating sickness

Isolated cases occurred in the Orange Free State and Transvaal Regions. The disease was widespread in Zululand and the Potchefstroom State Veterinaryian's area.

Virus pneumonia of calves

No cases were reported.

DISEASES OF POULTRY

Infectious bronchitis

The use of the Onderstepoort vaccine has resulted in a decrease in the economic importance of the disease. Isolated cases were reported in the Winter Rainfall and Transvaal Regions.

Infectious coryza of fowls

One case of the disease diagnosed in the Upington State Veterinarian's area.

Field trials on the efficacy of an oil adjuvant vaccine were continued by the Veterinary Research Institute, and very satisfactory results were obtained. No new cases of the disease occurred on one farm during the 18-month test period. On a second farm the incidence of symptoms of the disease decreased dramatically and secondary infections have become so rare that it is no longer necessary to use antimicrobial drugs. A few snags have arisen with regard to quality control tests which are conducted on the vaccine. As soon as these have been solved the vaccine will be released.

Chronic respiratory disease (Mycoplasmosis)

In the Transvaal and Highveld Regions isolated outbreaks were reported. The disease plays an important role in the Winter Rainfall Region, where the Regional Veterinary Laboratory at Stellenbosch aids farmers in the diagnosis and limiting of the disease. It is the most common disease of poultry in the O.F.S. Region.

Fowl pox

The effective vaccine available has resulted in the occurrence of only isolated outbreaks throughout the country, except in Natal where favourable climatic conditions gave rise to a number of outbreaks.

Gumboro disease

In the Winter Rainfall Region there is a definite increase in the occurrence of cases of this disease in broiler chickens, with a mortality of up to 15%.

DEFICIENCY AND NUTRITIONAL DISEASES

As a result firstly of drought, and then excessive rain, these conditions once again were evident throughout the country.

Phosphate deficiencies played a role largely in winter in connection with lowered fertility in the Eastern Transvaal, O.F.S., Natal and the Winter Rainfall Regions. Supplementation by means of mineral licks alleviated the problem. However, in the Ixopo State Veterinarian's area it was found that cattle did not make use of such licks, even though there was a shortage of phosphate. Where trace element analyses showed that the ratio of phosphorus to calcium was too high, for example in the Winter Rainfall Region, this led to the formation of kidney stones and malformation of bone in horses.

Vitamin A deficiency was found in the O.F.S. Natal, Winter Rainfall and Transvaal Regions particularly in the winter months. Supplementation with synthetic Vit. A led to increased fertility. Borehole water with a high nitrate content gave rise to Vit. A deficiency in the Pretoria State Veterinarian's area. Once again synthetic Vit. A solved the problem.

Zinc deficiency was established in the State Veterinarian areas of Louis Trichardt and Lydenburg, as well as in the Fouriesburg District.

Magnesium deficiency plays an important part in the Eastern, Central and Southern Free State among sheep. The same applies to the Herbert District. Magnesium deficiencies were also evident on pastures in Natal and the Winter Rainfall Region.

Copper deficiency was found in stock on pastures in Natal. A deficiency of this mineral was also found in cattle in Bethlehem. Parts of the coastal area of the Winter Rainfall Region are also troubled by this deficiency.

Excessive fertilisation with calcium, particularly on clover and lucerne pastures suppress the intake of manganese, in the Winter Rainfall Region, with a resultant manganese deficiency.

Iodine deficiency occurs in the Drakensberg high-lying parts of Natal.



Electrocardiographic studies are made on diseases like gousiekte and gifblaar poisoning caused by cardiac toxins

The Regional Veterinary Laboratories at both Stellenbosch and Allerton have done a great amount of work in connection with organ analyses and metabolic profile determination in order to try and solve problems connected with breeding, stunted growth and deficiency diseases.

Quite a number of cases of milk fever occurred in the Upington State Veterinarian's area, while ketosis was found in sheep in Upington and Calvinia State Veterinarian areas.

Mineral imbalances of ruminants in South Africa

Further atomic absorption spectrophotometry analyses were conducted by the Veterinary Research Institute on liver specimens to determine the mineral balance in ruminants in various regions of South Africa. Specimens were received from all the provinces, South-West Africa and Swaziland.

The following trace element and phosphate deficiencies were recorded:

(i) Cattle

- (a) *Transvaal* — Copper in the central portion and zinc in the eastern Transvaal Highveld.
- (b) *S.W.A.* — Manganese, zinc and copper in the central portion and magnesium in the north and south of S.W.A.

(ii) Sheep

- (a) *Transvaal* — Copper in the Central and Northern Transvaal as well as the Eastern Transvaal Highveld; zinc in the latter area; sporadic phosphate deficiencies.
- (b) *O.F.S.* — Copper in the Bloemfontein District.
- (c) *Cape* — Copper and manganese in the North-Western Cape; manganese and magnesium in the eastern Karoo (Middelburg).
- (d) *S.W.A.* — Copper, zinc and phosphate in the central portion with sporadic phosphate deficiencies elsewhere; zinc deficiencies occur in the south.

Excessive amounts of the trace element copper were found in the Middelburg (Cape) and Fauresmith Districts.

Mineral and protein imbalances in foals

A group of yearling foals at the Veterinary Research Institute, fed on a ration with a medium protein and low, imbalanced calcium and phosphate content, developed typical signs of rickets such as open knees and thickened costochondral junctions.

A second group that received a high protein diet with normal calcium and low phosphate content, but with imbalances between the minerals as well as between the protein and the minerals, developed classical block hoof. The tendons were not contracted. This well-known clinical condition is therefore due to a nutritional disturbance rather than a hereditary condition, as was previously thought to be the case.

Ceroid syndrome in pigs

This syndrome is characterised by haemorrhages in cardiac tissues of pigs and is due to the destructive effect of rancid fats on Vitamin E in a ration with a high fat content. This effect can be eliminated by the addition of an antioxidant to the ration. In the absence of the latter Vitamin E injections at the Veterinary Research Institute only had a protective effect if the pigs were fed on a ration containing 3% and less fat. Pigs receiving a ration containing 6% and 9% fat still developed the syndrome.

POISONING

Mineral poisoning

Various cases of poisoning with a variety of poisons were encountered in all regions. In most cases the accidental intake of poison was a result of negligence on the part of the owner.

Although arsenic has been withdrawn as a dipping remedy, various cases of arsenical poisoning have occurred. In Bophuthatswana 9 animals died as a result of arsenic. In Fauresmith an old tin containing locust poison was accidentally opened next to a dam, and this led to the death of 8 cattle. Cases also occurred in Louis Trichardt, Barberton, Bethlehem and Kroonstad. Cases also occurred in the Transvaal and Winter Rainfall Regions.

Insecticides containing organo-phosphates and/or chlorinated hydrocarbons were responsible for a large number of deaths. In Mossel Bay a land was sprayed from the air and 300 sheep were affected. Prompt treatment resulted in only 2 of the 300 animals dying. Cattle died in a similar incident in the Standerton State Veterinarian's area.

Urea poisoning also took its toll. In the Transvaal Region this was the chief cause of mineral poisoning. In one case 694 animals were affected, of which 9 died. In Clanwilliam 23 sheep died from urea poisoning.

Enzootic icterus, a form of chronic copper poisoning, occurred in the O.F.S., Eastern Cape and Karoo Regions.

Seven animals died of lead poisoning in the Standerton District, while one case occurred at Vryburg.

Mercury poisoning caused the death of two bovines in the Potchefstroom District.

Three cattle died in Kroonstad District from nitrate poisoning.

Salt poisoning caused deaths in the Oudtshoorn District, and cases of fluorine poisoning occurred in the Great and Little Brak River areas.

Warfarin was responsible for the death of a dog in Bethlehem.

Cases of strychnine poisoning in dogs were confirmed in all regions.

The Veterinary Research Institute found that the commonest forms of poisoning in ruminants, particularly cattle, were arsenic, urea, chlorinated hydrocarbons and organophosphates, while in dogs the commonest chemical poison was strychnine.

Plant poisoning

According to reports from the regions the following plants were responsible for stock losses: *Tulp* (*Homeria* & *Moraea* spp.) in all seven regions as well as the Ciskei and Transkei; *Senecio* spp. in the Winter Rainfall, Eastern Cape and Karoo, Natal (here the plant seems to be spreading) and Highveld Regions, as well as the Ciskei and Transkei; *Geigeria* spp. in the O.F.S., Highveld and Eastern Transvaal Regions; *Urginea* and *Ornithoglossum* spp. (Slangkop) in the Natal, O.F.S. and Highveld Regions; *Lantana camara* in the Transvaal, Natal and Eastern Transvaal Regions; *Crotolaria* spp. in the Transvaal and Eastern Transvaal Regions and also in Lebowa; *Pachystigma* and *Pavetta* spp. (Gousiekte) in the Transvaal and Eastern Transvaal Regions; *Dichapetalum cymosum* (Gifblaar) in the Transvaal and Eastern Transvaal Regions; *Cotyledon* spp. (Krimpsiekte) in the Eastern Cape and Karoo and Winter Rainfall Regions (938 head of small stock died in the Calvinia State Veterinarian's area from this plant); *Melanthus major* in the Winter Rainfall and O.F.S. Regions; *Cestrum* spp. (inkberry) in the Natal Region

and the Transkei; *Matricaria* spp. in the Natal Region; *Galaenia africana*, *Asaemia axillaris*, *Hermannia paucifolia*, *Cynanchum* spp. and *Malva parviflora* in the Winter Rainfall Region; *Hertia pallens*, *Thesium trifolium* and *Amaranthus* spp. in the Eastern Cape and Karoo Region; *Solanum kwebense* in the Transvaal Region; *Ornithogallum ornithogaloides* (chinkerinchee) and *Chrysocoma tenuifolia* (bitter karoo) in the O.F.S. Region and *Ricinus communis* (castor oil) in the Eastern Transvaal Region.

It was only in the Transvaal Region that prussic acid was not a cause of stock losses. In the Calvinia State Veterinarian's area 777 sheep died from prussic acid poisoning.

Cases of geeldikkop occurred in the Winter Rainfall, Highveld and Eastern Cape and Karoo Regions.

The abnormally heavy rains prevented geeldikkop from occurring in the Karoo this year and only one outbreak in the Calvinia District could be investigated by the Veterinary Research Institute. The discovery by officers of the Division of Veterinary Services, Middelburg, C.P., that deep frozen *Tribulus terrestris*, collected during an outbreak, can produce geeldikkop experimentally after several weeks of storage, will facilitate future research. In the light of this finding a joint programme has been drawn up with the Plant Protection Institute and the Regional Veterinary Laboratory, Middelburg, to study the mycoflora and toxicology of toxic *Tribulus* plants. In this study an attempt will be made to isolate the toxic principle from *Tribulus* and to characterise it.

According to the Veterinary Research Institute "gifblaar" (*Dichapetalum cymosum*) was responsible for most of the mortality investigated by the Institute.

Two outbreaks of algae poisoning occurred in the Transvaal, amongst cattle at the Hartbeespoort Dam and sheep near Hendrina.

Toxins

Aflatoxicosis originating from maize was established for the first time in the Republic amongst pigs in the Kenhardt District. The diagnosis was confirmed by the Veterinary Research Institute.

Diplodea zeae poisoning was reported from the Transvaal and Highveld Regions. Cases of fungus poisoning occurred in Vryheid where cattle ate fungus-infested grass seed.

Mouldy lucerne caused fungus poisoning in the O.F.S. Region.

INTERNAL PARASITES

The exceptionally high rainfall during the summer and autumn provided very favourable conditions for the multiplication of internal parasites. In some cases dosing had to be repeated every 10 to 14 days to control parasites. There were heavy losses as a result of infestation because farmers neglected to dose, in many cases, until the first deaths or obvious symptoms of infestation were seen.

Wireworm infestation (*Haemoncus spp.*) was rife in all the regions and the homelands; liver fluke (*Fasciola spp.*) in the O.F.S., Natal, Transvaal, Highveld and Eastern Transvaal Regions; nodular worm (*Oesophagostomum spp.*) in the O.F.S., Natal Eastern Transvaal, Eastern Cape and Karoo and Transvaal Regions; bankrupt worms (*Trichostrongylus* and *Cooperia spp.*) in the O.F.S., Natal, Transvaal, Eastern Cape and Karoo Regions; conical fluke (*Paraphistoma spp.*) in the O.F.S., and Highveld Regions; *Trichuris ovis* in sheep in the O.F.S., and Eastern Cape and Karoo Regions (it would appear to be spreading in the Karoo); lungworm (*Dictyocaulus spp.*) and hookworm (*Bunostomum spp.*) in the Natal Region, and brown stomach worm (*Ostertagia spp.*) and Long-necked bankrupt worm (*Nematodirus spp.*) in the Eastern Cape and Karoo Region.

Tapeworm infestation in young animals played a role in the O.F.S., Bophutatswana and the Eastern Cape and Karoo Regions.

In the Vryburg State Veterinarian's area measles resulted in the condemnation of carcasses. 6% of cattle carcasses and 2% of pig carcasses were condemned.

Liver tapeworm (*Stilesia hepatica*) was responsible for the condemnation of 90% of sheep livers and 20% of cattle livers in the chief abattoirs in the O.F.S. Region.

Cases of gid (*Coenuris cerebralis*) also occurred in the O.F.S., Eastern Cape and Karoo Regions.

Nasal worm (*Oestrus ovis*) caused problems in the Calvinia State Veterinarians area, and also in the Transvaal Region.

Bilharzia

As a preliminary study to an investigation on the immunity in Bilharzia, an experiment was conducted at the Veterinary Research Institute to determine the lethal dose (LD) of *Schistosoma mattheei* for cattle. It was found that the LD₅₀ was in the vicinity of 240 cercariae per kg live mass. The cattle died from 58 to 70 days after infestation.

Cattle given fairly severe primary infestations and challenged 12 months later with twice the lethal dose all

survived the reinfestation. It is therefore clear that cattle do develop an immunity to further infestation with bilharzia.

A thorough investigation of the pathology of the urinary tract was conducted on 40 cattle infested experimentally or spontaneously with *S. mattheei*. Extensive macroscopic lesions were found in the renal pelvis of 20%, the ureters of 58% and the bladders of 75% of the animals. An extended prepatent period for urinary lesions could be postulated on the absence of lesions in the ureters and bladders of animals infested less than 185 days (about 6 months). The effects of reinfestation were of a quantitative as well as qualitative nature, that is to say, a larger percentage of reinfested cattle presented bladder and ureteric lesions which were more severe and more chronic.

EXTERNAL PARASITES

As a result of the phenomenal rains, ticks caused tremendous problems in the whole of the Republic. Reports have come in from all regions on the increasing resistance that ticks are developing to available dips. Factors that have led to this state of affairs include the dipping of animals in dips of too low a concentration, and the irregular dipping of stock.

It has been known for some time that strains of the blue tick, *Boophilus decoloratus*, are resistant to some members of the organophosphate group of insecticides. It has also been established recently at the Veterinary Research Institute that strains of *B. decoloratus* from the Naboomspruit District of the Transvaal are resistant to the organophosphates benoxafos, carbophenothion, diazinon, dioxathion and quinthiophos. These ticks can, however, still be controlled by fenchlorvinphos. It is suspected that similar resistance has developed in several other districts in the Transvaal and blue ticks from these areas are at present being tested to verify this suspicion. If this proves to be correct it means that the number of dips that can be used in the Transvaal where blue ticks prevail will be very limited.

The "bontpoot" tick (*Hyalomma spp.*) is the commonest tick in the O.F.S. Region, and infestation with this tick caused lameness, abscesses on the body, mastitis and foot-rot. In the Calvinia State Veterinarian's area the ticks also caused lameness in small stock.

In the mountainous parts of the Calvinia, Williston and Clanwilliam Districts, the Central and Southern O.F.S., the Eastern Cape and Karoo Region, the paralysis tick (*Ixodes rubicundus*) caused problems. The presence of the red tick (*Rhipicephalus evertsi*) was confirmed in the vicinity of Barkly West.

The Kalahari sand tampan (*Ornithodoros savignii*) was once again responsible for losses in the Vryburg-Kuruman area.

Sheep lice were found in all regions as well as in Venda. In the O.F.S. Region cattle lice caused problems, especially in animals in poor condition.

There were problems with sheep keds (*Melophagus ovinus*) in the O.F.S. and Eastern Cape and Karoo Regions.

The Australian itch-mite (*Psorergates ovis*) was widespread in the Winter Rainfall, Eastern Cape and Karoo and O.F.S. Regions, particularly in the Bloemfontein State Veterinarian's area.

Midges (*Culicoides spp.*) were a terrible plague in the Winter Rainfall and O.F.S. Regions. In the O.F.S. Region the midges gave rise to one of the severest outbreaks of bluetongue ever.

As was expected by the Veterinary Research Institute, the filling of the Verwoerd Dam and the consequent alteration of the ecology of the Orange River below the dam have resulted in the development of a plague of these midges, chiefly in the Douglas, Prieska and Upington areas. DDT was used for the control of the immature aquatic stages in the past. Since DDT is no longer available it has become essential to find an alternative insecticide. Thirty products were selected for trial purposes. On account of the copious rains and resultant floods only 10 insecticides could be tested to date, some of which have shown very promising results.

Mosquitoes were a plague in the O.F.S. Region, and caused the most cases yet of disease transmissible by them.

Parafilaria bovicola infection of cattle was common in the Eastern Transvaal and in the bushveld areas of the Transvaal Region. Infection by the parasite was also encountered in Venda.

Investigations on the transmission of this worm parasite by the Veterinary Research Institute were extended to 12 farms in the enzootic region in the Transvaal, which include the Mara and Zoutpan Research Stations. Cattle on all these farms were infected. This was determined by noting the bleeding spots caused when the female worms under the skin perforate it when laying eggs so that blood trickles down the skins of cattle. The main bleeding period was from July to December when up to 25% of the cattle had blood marks on their skins. After January less than 10% of the cattle showed blood marks.

Each month a batch of 100 ox carcasses was examined at the Pretoria abattoir to determine the

incidence of *Parafilaria* carcass lesions at different times of the year. Fewer lesions were noted from March to June. This period coincides with the last 4 months of the period during which few bleeding spots were seen on live cattle.

More than 10 000 flies were collected off cattle at the localities mentioned above. They were identified and examined for developing larvae of *P. bovicola*. Of the 12 fly species commonly collected, three *Musca spp.* were found to be infected with *Parafilaria* larvae. Infected flies were only found between August and February, so this is likely to be the main period for worm transmission.

The same three fly species were successfully infected artificially in the laboratory. The measurements of these larvae tallied closely with those of larvae recovered from field collected flies.

Since the three suspect fly transmitters feed mainly on eye secretions it is thought that most transmission will take place via the eye. Thereafter development in cattle to the mature female worm probably takes approximately 7 to 10 months. Experiments are in progress to prove the route of infection and the developmental period.

An investigation on the chemotherapy of *bovicola* infection has also been initiated at Zoutpan.

Infection with *Demodex spp.* was common in dogs in the Eastern Transvaal and in Venda. Buffalo in the Kruger National Park were also found to be infected with this parasite.

Some cattle imported from the U.S.A. were found to be infected with *Hypoderma bovis* larvae. On one farm where the cattle had not yet been dipped live larvae were found. The necessary steps were taken to prevent the development of the larvae.

Biting flies caused problems in Natal, mostly in the Lower Tugela and Inanda Districts. In the Kuruman-Vryburg area of the O.F.S. Region these flies were also a nuisance.

Extensive blindness due to ophthalmia was found in sheep on a few farms in the North-Western Cape. *Chlamydia* could be demonstrated in impression smears and isolated in eggs from the eyes of slaughtered animals which were submitted to Onderstepoort.

Midges and various fly species were also caught by officials of the Veterinary Research Institute on the sheep for studies on a possible mode of transmission of the ophthalmia. *Chlamydia* could be demonstrated by egg inoculation in *Musca domestica*, *M. sorbens*, *M. xanthomelas* and *Simulium spp.*, whereas *Mycoplasma oculi* was found in *Fannia spp.*

BASIC VETERINARY RESEARCH

Sweating Sickness

The pathology of sweating sickness was studied at the Veterinary Research Institute in cattle and sheep by means of post-mortem examinations augmented by light and electron microscopic observations. The most important pathological changes were:

- (i) Initial oedema followed by total necrosis of the superficial layers of the skin.
- (ii) Affection of the blood vessels of the skin and other portions of the body.

In general the pathological changes indicate that sweating sickness is caused by a toxin, which serves to strengthen the hypothesis expressed several years ago on the basis of biological observations that sweating sickness is a tick toxicosis.

Ruminant digestion

When a ruminant is changed abruptly from a high roughage to a rich carbohydrate diet acute ruminal acidosis commonly occurs as result of the accumulation of lactic acid. This may be avoided by a gradual change which allows the microbial population to adapt to the new diet. The essential changes which occur with a gradual, step-by-step change were studied in sheep. It was found at the Veterinary Research Institute that the organisms which store dietary carbohydrates and utilise lactic acid increased in numbers as the carbohydrate level rose, whereas the organisms which digested cellulose remained constant in number. A fairly well balanced ruminal population was therefore maintained.

Research on game and the disease of game

Research on diseases of game is continuing in the Kruger National Park.

Cytauxzoonosis was diagnosed in roan antelope, reedbuck and kudu.

In co-operation with Onderstepoort it was found that elephants had antibodies to horsesickness. However, horsesickness virus could not be isolated from elephant blood.

Eland and roan antelope kept in a camp near Pretoriusskop were found to be heavily infested with internal parasites. Common worm remedies were used to dose the animals after they were caught, and positive results were obtained.

Linguatula nuttali was also successfully transmitted artificially from a lion to a bovine.

Attempts are being made by officials at Skukuza and others to inseminate cheetah artificially.

Teeth from 500 buffalo were cut, ground and polished in order to determine the age of the animals. This information, in conjunction with the physical appearance of the individual animals, is used in efforts to determine the growth rate of buffalo.

A start has also been made with the determination of the safety of certain dips and insecticides for game animals. Amongst other things, it has been shown that cheetah are exceptionally susceptible to Malathion poisoning.

VACCINE PRODUCTION

The number of vaccines issued by the Veterinary Research Institute at Onderstepoort has now increased to 36 with the addition of the vaccine against elephant skin disease of cattle.

The number of doses of vaccine issued during the year also reached a new record level of 152 509 615, which represents an increase of 9% on the total of the previous year. The accompanying record of vaccines and diagnostic aids lists comparative figures for vaccines issued during the past 3 years and the phenomenal increase in the demand for vaccines since 1959/60 is clearly illustrated in the graph. The increase over the past 15 years was almost 200%.

On account of favourable climatic conditions the incidence of horsesickness was very high, even in immunised animals. A timely investigation revealed that most horses died as a result of infection with Type 4 virus, which was not present in the vaccine. A special monovalent Type 4 vaccine was promptly prepared and made available to farmers. Use of this vaccine resulted in a dramatic decrease in horsesickness. This virus strain will be included in the standard polyvalent horsesickness vaccine in future.

The increase in the number of doses of vaccine issued this year can be ascribed to an increased demand for virtually all vaccines used in sheep, and cattle. The most important of these were: enterotoxaemia vaccine for sheep (increase almost 8 million or 25%), enzootic abortion for sheep (increase more than 2 million or 1285%), botulism (more than 1 million or 28%), anthrax (5,49 million or 52%), pasteurilla (356 520 or 52%), black quarter (2,1 million or 42%) and bluetongue (13,7 million or 118%). The demand for poultry vaccines dropped by 23,2 million doses or 51%.

The following vaccines were produced by State Veterinarians in the field:

Heartwater	— 6 681 doses
Autogenous wart vaccine	— 2 190 doses
Orf	— 3 632 doses
Actinobacillus seminis	— 90 ml (experimental vaccine)

Bacterial Vaccines

	1971/72	1972/73	1973/74
Enterotoxaemia	30 923 350	31 512 900	39 357 500
Lamb Dysentery	1 070 300	228 250	409 870
Brucella (cattle)	1 447 605	1 679 465	1 889 999
Brucella (sheep)	421 350	407 450	514 300
<i>Corynebacterium ovis</i>	214 820	44 680	156 520
<i>Corynebacterium pyogenes</i>	209 960	249 960	348 180
Swelled head in rams	24 400	29 150	23 270
Colibacillosis (cattle and sheep)	14 940	14 200	41 570
Colibacillosis (pigs)	—	7 800	74 930
Enzootic Abortion (sheep)	—	156 300	2 164 200
Fowl Typhoid	1 785 200	1 846 500	2 469 100
Botulism	3 887 185	4 188 297	5 363 070
Leptospirosis	2 352	2 740	1 710
Bovine Pleuropneumonia	1 037 571	436 280	575 360
Anthrax	12 222 430	10 445 640	15 936 950
Paratyphoid (calves)	263 638	314 484	364 650
Pasteurella	481 880	682 700	1 039 220
Black Quarter	4 645 638	5 080 916	7 257 052
Tetanus	60 810	82 460	195 850
Total for 19 bacterial vaccines	58 713 429	57 410 172	78 183 307

Bluetongue	2 789 200	4 202 400	2 221 000
Pigeon Pox	—	—	1 200 000
Fowl Pox	16 771 600	11 663 700	25 366 550
Distemper	684 300	797 200	754 000
Rabies (LEP for dogs)	6 680 800	7 913 600	4 429 800
Rabies (HEP for cats)	21 105	28 286	31 960
Infectious bronchitis (poultry)	437 475	247 937	165 280
Infectious laryngotracheitis (poultry)	2 936	16 956	17 270
Lumpy Skin Disease	320 538	371 176	744 970
Newcastle Disease (poultry)	40 846 400	56 550 500	37 481 600
Horsesickness	128 240	142 199	184 860
Monovalent Type 4 Horsesickness	—	—	137 400
Rift Valley Fever	105 790	18 896	601 600
Wesselsbron Disease	181 450	23 650	148 570
Total for 14 virus vaccines	68 969 834	81 976 500	73 554 890

Other Vaccines

Anaplasmosis (Gallsickness)	468 642	381 057	524 920
Heartwater Blood	52 386	59 402	78 370
Redwater	67 025	64 155	106 970
Elephant Skin Disease	—	—	61 140
Total for 4 other vaccines	488 053	504 614	771 410
Grand Total for all vaccines	128 171 316	139 891 286	152 509 615

Diagnostic Aids (antigens) number of units

B.W.D. antigen	34 755	43 790	54 740
<i>Brucella abortus</i> antigen	—	9 800	29 200
Brucella ring test antigen	579	320	621
Mallein	10	10	120
Tuberculin (bovine)	679 670	755 170	642 900
Tuberculin (avian)	262 430	313 700	199 102

9 000 ml of leptospirosis antigen was prepared by the Regional Veterinary Laboratory at Stellenbosch. The Regional Veterinary Laboratory at Middelburg, Cape, prepared 311 ml of *A. seminis* antigen.

The production of Redwater vaccine at the Regional Veterinary Laboratory at Allerton, was stopped during the year.

DIAGNOSTIC SERVICES

This service was extended and improved at the Veterinary Research Institute by propagating the importance of submission of fresh specimens.

Good progress has been made with the application of the immunofluorescence technique to diagnostic procedures. It is now being incorporated as a routine in the diagnosis of *Vibrio fetus*, *Leptospira*, *Mycoplasma*, *Actinobacillus*, *Brucella*, *Trichomonas foetus* and *Chlamydia* infections. The following isolates could, for example, be classified with the aid of this technique: 590 *Mycoplasma*, 194 *V. fetus* and 85 *T. foetus*. Regional laboratories are already being supplied with *Vibrio* conjugates prepared at Onderstepoort and it is also intended to furnish them with *Mycoplasma*, *Actinobacillus* and *Trichomonas* conjugates.

During the past year 1 575 specimens were examined for *Chlamydia*. Isolation techniques proved to be much more accurate than direct microscopic examination of impression smears. *Chlamydia* could, for example, be isolated from 67% of the specimens, whereas only 40% of cases could be diagnosed by means of smears. The spleen, brain, bladder wall, conjunctiva, ileum and gallbladder wall proved to be the most satisfactory material to use for isolation of the organism.

The standard serum neutralisation test for IPV virus in bovine semen was improved by elimination of the toxic effect of seminal plasma on cell cultures. The gel diffusion technique was applied successfully to the diagnosis of mucosal disease and bluetongue in cases like perinatal losses, where it is not always possible to isolate the offending virus.

The revised regulations for fees payable in respect of laboratory tests have not been published as yet, but will appear early in the next year.

In the course of diagnostic work a total of 5 065 post-mortem examinations on cattle, sheep, goats, pigs, equines, dogs, cats and other animals were performed by State Veterinarians of the Division of Veterinary Services, and 1 848 post-mortems were performed in addition to this by the Veterinary Research Institute.



An ox being bled for the production of gallsickness vaccine

SURVEYS

State Veterinarians of the Division carried out 24 620 post-mortem examinations on poultry, a further 4 776 post-mortem examinations of poultry being done by the Research Institute.

The following laboratory examinations were carried out at the Research Institute, regional veterinary laboratories and State Veterinarians' offices.

	Division	Research Institute
Brucella agglutination tests	64 657	19 147
Comparative Brucella tests to eliminate vaccine reactors	—	2 554
Vibriosis	34	4 802
Johne's Disease	—	451
Leptospirosis	2 732	1 929
<i>Actinobacillus seminis</i>	19 474	—
Pasteurellosis	3 121	—
Chlamydiosis	121	1 575
Dourine	—	1 786
Rabies	—	1 119
Antibiograms	664	167
Skin scrapings	298	—
Faeces samples	5 945	617
Identification of internal parasites	—	325
Examination of milk for mastitis	8 522	7 434
Semen examinations	1 649	—
Examination of sheath washings	187	—
Examination of aborted fetuses	296	—
Haematological examinations	390 026	—
Biochemical examinations	51 680	—
Toxicological examinations	846	1 986
Bacteriological examinations	21 690	—
Virological examinations	309	2 553
Protozoological examinations	31	—
Biological examinations	88	—
Serotyping of cultures	—	3 188
Histopathological examinations	1 303	4 138
Poultry samples examined	—	12 500
Trichinella examinations	233 418	—
Abattoir by-products examined	—	168
Smear examinations	316 081	—
Ascheim Zondek tests	420	—
Identification of insects and ticks	—	1 847
Clinical examination of animals	48 222	—
Total	1 171 814	68 286

The survey mentioned in the previous report, to determine the normal values in respect of minerals in liver analyses, was completed at Stellenbosch Regional Veterinary Laboratory on 8 different species of animals.

The State Veterinarian, Barberton, is busy with a survey to determine the calving percentages and pre-weaning mortality in herds containing more than 50 female breeding animals.

In the Louis Trichardt State Veterinarian's area a survey is being conducted in conjunction with a private firm to determine the degree of resistance to existing dips.

Clinical Services

Whenever State Veterinarians' official duties allow it, they have as in the past, rendered clinical services to the farmer. This is generally done in areas where there is no private practitioner. Veterinary services are also provided for State-owned herds.

During the year under review a sum of R24 400 was collected for professional services rendered, R5 332 for mileage fees and R9 974 for vaccine sold through State Veterinarians' offices. R3 209 was collected for laboratory examinations; R98 892 for inspections at export abattoirs; fees for the quarantine of animals and birds at quarantine stations amounted to R76 134 and miscellaneous revenue R3 873.

ARTIFICIAL INSEMINATION

The A.I. and Reproduction Section of the Division of Veterinary Services tested 124 bulls, for the annual re-registration of bulls standing at A.I. Co-operatives, for individual owners, and also for the registration of new bulls.

Progeny testing of A.I. bulls is at present being carried out by three of the A.I. co-operatives.

At present there are 11 bulls that react positively to the Infections Pustular Vaginitis serum/virus neutralisation test. The semen of these bulls is regularly tested for the IPV virus before the sale of the semen is allowed. Four bulls were not re-registered this year because of high sperm abnormality counts and the poor freezing quality of their semen.

During the year under review 328 000 doses of frozen semen were produced at the A.I. co-operatives. Approximately 154 000 cows and heifers were inseminated by farmers and inseminators, this figure representing only 5% of the total number of cows and heifers in the country.



A record consignment of vaccines was despatched during the summer of 1973/74

At present, A.I. co-operatives supply semen from 8 different breeds. Frieslands and Jerseys are the most popular dairy breeds, while the Brahman is the most popular beef breed.

The conception rate after a single insemination averaged 72%.

The A.I. and Reproduction Section are doing research on the freezing of goat semen and A.I. in goats.

During the year the A.I. and Reproduction Section at Onderstepoort only had two courses for prospective registered inseminators. 24 of the 29 students qualified as "competent inseminators". Most farmers do the inseminations themselves, or they employ White or Non-White non-registerable inseminators. This result in a decrease in the number of posts for registered

inseminators, and thus in the number of courses and students.

In addition to the above courses, the A.I. and Reproduction Section ran four courses for Non-Whites, who may only inseminate their own stock or that of their full-time employers. In the four courses offered during the year, 52 out of the 73 candidates were successful. Follow-up work showed that labourers who had been trained in the past two years were obtaining a conception rate of 82% after one or more inseminations.

At Potchefstroom, 18 courses were attended by 266 farmers who wish to do A.I. in their own herds.

Four courses at Glen were attended by 55 farmers.

At Louis Trichardt a short 4-day course was attended by 15 farmers, while Cedara also ran a short course.

HEALTH SCHEMES

Bacillary White Diarrhoea (B.W.D.) and Fowl Typhoid (F.T.) Scheme

Details of tests done and certificates issued during the year are as follows:

Meat and Animal Products Hygiene Act, 1967, is not applicable to this Homeland other than to its urban areas. For the year under review the following number of certificates of approval have been cancelled owing to the closure of the abattoirs for stock-slaughtering purposes:

Region	Flocks	Tests			Certificates	
		Positive	Fowls Suspect	Total	Holders	Number of Fowls
Eastern Cape and Karoo	1	—	—	1 500	1	1 500
Highveld	11	—	—	51 134	11	209 915
O.F.S.	3	—	—	3 735	3	4 185
Transvaal	26	—	—	310 911	26	310 911
Winter Rainfall	25	—	16	200 068	25	958 151
Eastern Transvaal	1	—	—	4 362	1	4 362
Total	67	—	16	391 710	67	1 519 024

P.P.L.O. Scheme

Cape Province 100, Natal 40, Orange Free State 11, and Transvaal 37.

Particulars of tests done under the scheme are summed up below:

Two poultry abattoirs have been closed, and one rabbit abattoir.

Region	Positive	Fowls Tested		Total	Certificate holders	Tests on fowls in flocks of non-certificate holders
		Suspect	Non-specific			
Highveld	—	—	—	9 543	2	2 758
O.F.S.	—	16	—	330	1	—
Transvaal	—	—	—	21 215	2	20 450
Winter Rainfall	632	394	632	21 908	14	—
Total	632	410	632	52 996	19	23 208

Pig Recording and Health Scheme

During 1973/74 the number of members rose from 46 to 53, and the number of pigs on members' farms rose from 34 078 to 53 043.

New abattoirs were built by the Municipalities of Utrecht, Queenstown, Bloemhof and Kuruman. A few private abattoirs were also completed, including a big poultry abattoir and a fairly big rabbit abattoir.

Subsidy paid to local authorities in accordance with section 20(1) of Act 87 of 1967 amounts to R252 299 for 175 meat inspectors employed by these local authorities.

MEAT HYGIENE

Abattoirs

The Division of Veterinary Services has on record a total of 1 155 abattoirs consisting of 1 029 red meat abattoirs, 115 poultry abattoirs and 11 rabbit abattoirs. The provincial distribution of the abattoirs is: Natal 161, Cape Province 458, Transvaal 336, and Orange Free State 74.

The above-mentioned figures do not include abattoirs in the Transkei, because the Animal Slaughter,

Sterilisation Installations

State Veterinarians are inspectors in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947.

In the Republic of South Africa a total of 71 such installations were registered. State veterinarians inspected these installations on an annual basis or more often whenever problems were encountered.

Where such an installation is an integral part of an abattoir, it must also meet the requirements of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967.

Planning

A total of 94 plans and drawings of abattoirs, factories and refrigeration plants were received by the Division of Veterinary Services for comment and consideration for approval in accordance with the requirements of Act 87 of 1967 and its Regulations; this keeping with the provisions of section 18 of the Act. Of these, 33 were entirely new proposals (11 from the private sector); 29 were planned improvements to existing premises (more than 30% private); 20 for new poultry abattoirs, 9 new rabbit abattoirs, one game abattoir and three abattoirs in various Homelands.

The plans and drawings received, of new schemes as well as of improvements to existing premises, contained a comprehensive cross section of the various premises and the nature of operations required to cater for the demands of the modern meat industry, viz standard abattoirs for red meat, factory-abattoirs, processing plants, chilling and freezing plants, deboning plants, by-products plants, dewatering towers, etc.

The Division is of the opinion that progress has been made in the promotion of hygienic practices in South Africa.

Meat Imports

The Republic still imports meat from Rhodesia, Botswana and Swaziland.

Meat Exports

During the year under review the Division of Veterinary Services devoted a considerable amount of time and effort to improving standards at the various establishments. With the cordinal co-operation of the management at these plants great improvement in both facilities and procedures was achieved during the year under review.

That the improvement was real and obvious was borne out by the verbal comments and reports of veterinary inspectors from the United Kingdom.

During the year two new establishments were added to the list of deboning establishments approved for export to the E.E.C. countries and two were removed because their standards were no longer sufficiently high.

Meat and meat products were exported to fifteen different countries as well as to the so-called free ports.

The export of rabbit meat to the U.K. has been initiated. Venison has also been exported, mainly to France.

STOCK INSPECTION SERVICES

The outbreaks of swine fever and foot-and-mouth disease that occurred during the year, with the resultant temporary transfer of stock inspectorate personnel to the infected and threatened areas to combat the outbreaks and prevent the spread of infection, resulted in the routine duties of the staff concerned falling somewhat behind schedule.

The reorganisation and replanning of the stock inspectorate areas mentioned in the previous report have been completed.

ANIMAL HEALTH EXTENSION SERVICE

Extension services to farmers are carried out in various ways by officials of the Division of Veterinary Services. Group extension work is done by means of short courses in animal diseases, their prevention and control; lectures are given at farmers' days; participation in study groups; the distribution of inoculation and/or dosing programmes, etc. Personal extension in respect of individual farmers with specific problems is done during visits to farms, visits by the farmer to the Veterinary office, by telephone and by letter.

The stock inspectors, especially those who have already attended the in-service training course, are playing a greater role in this respect.

IMPORT CONTROL

To guard against the introduction of animal diseases remains one of the chief functions of the Division of Veterinary Services. Quarantine facilities are available at the Division's 4 quarantine stations for all domestic animals, poultry, parrots and other birds, rabbits and primates. Imports of animals and birds have increased tremendously during the past year.

During the past year the following animals were imported for slaughter, farming, or other purposes:

Cattle	17 351
Sheep	3 017
Goats	331
Pigs	18
Horses	106
Dogs	1 680
Cats	471
Poultry	14 702
Turkeys	5 600
Birds	96 523

Rabbits	110
Tropical Fish	1 358 822
Tropical Fish Eggs	1 936 380
Wild animals	234
Animals for zoos	444
Reptiles	484
Rodents	50

The following table gives an indication of the products that were imported under permits issued by the Division:

Biltong	9 981 kg
Frozen meat	6 271 960 kg
	452 railway truckfuls
poultry carcasses	5 000 units
Salami	300 kg
Sausage casings	993 844 kg
	3 257 tierces
Tallow	70 188 kg
	1 drum
Cream	211 344 litres
Butter	75 kg
Hides and Skins	3 604 915 kg
	80 t
	28 651 bales
	36 500 units
Wet salted hides	161 938 units
Hide trimmings	393 t
Rabbit fur	8 797 kg
Karakul pelts	28 856 units
Wool	125 503 kg
	4 224 bales
Undyed Wooltops	1 bale
Mohair	840 kg
Hair and bristles	216 717 kg
	4 cases
	2 259 cartons
Feathers	18 576 kg
	66 bales
Bone meal	2 510 t
Bones	748 000 kg
Carcass meal	286 t
Casein	32 723 bags
Hay	30 t
Processed skins and trophies	87 kg
	4 041 units
Ivory	677 kg
	10 068 units
Veterinary vaccines	451 261 250 doses
Veterinary remedies	603 cartons
	300 ml
Semen	3 363 doses

EXPORT CONTROL

For export purposes veterinary examinations and certifications were done in respect of the following

animals, according to the requirements of the importing countries:

Cattle	6 980
Sheep	807
Goats	187
Pigs	883
Equines	605
Dogs	1 653
Cats	208
Birds	599
Poultry	212 591
Rabbits	33
Wild animals	135
Laboratory animals	30
Reptiles	1

The products listed below were certified for export:

Frozen and chilled meat	12 325 941 kg
	61 carcasses
Canned meat	2 426 877 kg
	231 t
	17 757 cartons
Poultry meat	92 758 kg
	11 486 cartons
	300 carcasses
Venison	892 carcasses
Bacon	2 050 kg
Ham	90 778 kg
Canned fish	469 798 kg
Whale meat	2 064 255 kg
Sausage casings	69 227 kg
	61 t
Lard	8 550 kg
Hides and Skins	42 781 403 kg
	230 674 units
Ostrich skins	482 kg
Karakul pelts	1 434 333 units
Horns and hooves	359 003 kg
	2 361 bales
Hair and bristles	29 538 kg
Wool	47 723 488 kg
	52 117 bales
	23 samples
Mohair	1 476 873 kg
Ostrich feathers	41 825 kg
	4 bales
Feathers	37 303 kg
	23 cartons
Feather meal	47 849 kg
Lamb paunches	5 892 kg
Rennet	387 kg
Ox gall	1 988 drums
Glue	44 700 kg
Eggshells	952 kg
Fishmeal	1 319 524 kg
Whale protein meal	3 757 591 kg

Poultry feed	2 802 771 kg
Stock feed	4 758 320 kg
Lucerne hay	200 bales
Teff hay	14 t
Processed skins and trophies	2 215 units
Elephant skin	1 406 kg
Ivory	90 kg
Grain	46 500 624 t
Cotton seed	12 092 t
Beans	5 654 kg
Peas	9 627 kg
Sweetcorn	750 kg
Potatoes	994 961 kg
Onions	208 750 kg
	340 000 bags
Grapes	13 703 465 kg
Vegetable seed	150 kg

TRAINING

Once again State Veterinarians were responsible for the veterinary subjects in the diploma courses offered by the various Colleges of Agriculture and at Port Cox.

Fourteen State Veterinarians attended a short course dealing with the small stock industry held at the Regional Veterinary Laboratory, Middelburg, Cape.

The University of Pretoria ran a refresher course in meat hygiene in response to a request by the Division of Veterinary Services. The course was attended by 18 officials of the Division. Lectures were given to their young students by 5 of the officials.

The formal in-service training of members of the Inspectorate personnel, which was started in 1972, was continued. Four courses, each lasting 4 weeks, were attended by a total of 1 Chief Stock Inspector, 11 Senior Stock Inspectors and 115 experienced Stock Inspectors. An introductory course for junior members of the Inspectorate was attended by 24 officials. All told, 259 of the Stock Inspectorate personnel have done the course, and these officials are now playing a greater part in their various areas as regards extension work in animal diseases, vaccines and their use, first aid in emergencies, docking of lambs' tails, etc.

In all State Veterinarian areas at least one staff day was held where the State Veterinarian and Chief or Senior Stock Inspector gave lectures to the Stock Inspectors with regard to different aspects of animal health.

LEGISLATION

No Government Notices were published during the year in terms of the Animal Diseases and Parasites Act

(Act 13 of 1956), or the Animal Slaughter, Meat and Animal Products Hygiene Act (Act 87 of 1967).

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and Co-operation with African Countries

Five scientists from Angola, Mozambique, Malawi and Rhodesia visited the Veterinary Research Institute during the past year.

Vaccine manufactured by the Institute was sold to the following African countries:

Angola	1 001 020
Botswana	394 697
Lesotho	221 082
Malawi	610 815
Mozambique	20 365
Rhodesia	2 509 207
Swaziland	184 291
Zambia	2 929 000
Total	7 870 477

The Institute received 1 461 specimens for diagnostic purposes from African countries during the year.

Liaison with Overseas Countries

The Institute was visited by 59 scientists from 14 countries during the past year. The majority of these were short visits lasting from a few days to a number of weeks. Single visitors from the U.S.A., Switzerland and Australia spent longer periods of time at Onderstepoort as guest workers.

A total number of 330 tourists from abroad visited the Institute in organised groups.

Technical assistance and advice

World Reference Centre for Bluetongue (O.I.E.)

The production of type-specific antisera in chickens to the various bluetongue strains was continued.

Specimens were submitted to the Reference Centre from Israel and India for typing of bluetongue strains. The specimens from Israel were found to contain the Type 2 strain, a new intruder in that part of the world. The specimens from India are still being processed.

STOCK CENSUS

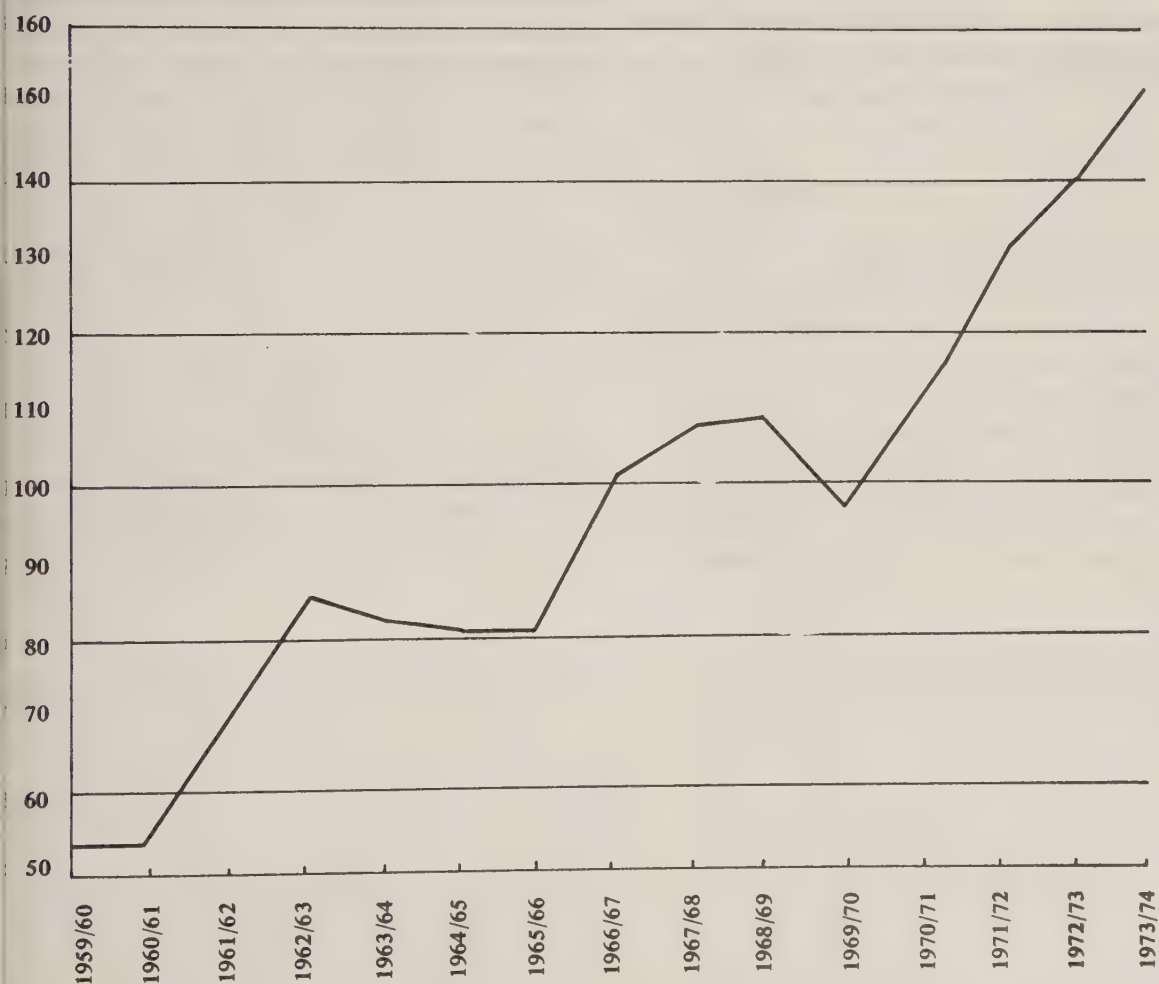
Region or Homeland	Cattle*	Sheep		Goats	Horses	Donkeys and Mules	Pigs	Poultry	Dogs
		Woolled	Non-woolled						
Winter Rainfall	361 487	2 761 192	1 240 213	362 832	17 459	9 100	150 607	3 832 103	63 450
Eastern Cape and Karoo	796 681	7 392 061	1 392 784	1 134 734	29 346	11 734	82 696	2 085 859	70 999
Transvaal	2 135 299	2 816 146	286 063	112 368	49 254	8 943	263 446	9 915 279	453 266
Natal	1 475 918	1 000 634	105 160	133 792	30 486	5 629	128 829	6 098 061	72 842
O.F.S.	1 229 135	2 864 522	3 420 615	505 573	41 934	18 512	105 053	824 339	49 645
Highveld	1 998 446	2 756 518	356 217	70 839	47 085	15 095	253 904	3 509 409	127 465
Eastern Transvaal	1 194 084	240 460	197 042	167 832	7 168	15 606	102 631	889 370	45 726
Transkei	1 194 181	2 347 830	—	1 330 312	103 303	16 457	32 032	1 107 152	403 864
Ciskei	203 909	479 743	—	328 824	8 228	2 522	27 176	179 718	26 184
Bophuthatswana	384 384	44 780	210 372	49 991	18 739	49 960	22 335	426 616	29 170
Basotho Qwa Qwa	6 315	4 022	—	9 605	989	34	253	9 508	480
kwaZulu	1 348 711	—	422 332	664 866	23 644	305	Not available	Not available	
Venda	100 567	—	3 545	55 987	26	2 973	6 284	19 471	14 500
Gazankulu	121 635	—	4 872	77 613	4	3 651	4 858	21 950	10 600
Lebowa	435 498	—	149 139	495 658	248	37 781	29 197	420 661	Not available
Total	12 986 250	22 708 088	7 788 354	5 500 826	377 913	198 302	1 209 301	29 339 496	1 368 191

* The figures for cattle are analysed in the following table

Distribution of Cattle

Region or Homeland	White Owners		Non-White Owners	
	White area	Non-White area	White area	Non-White area
inter Rainfall	357 975	—	3 512	—
estern Cape and Karoo	764 953	7	28 905	2 816
ansvaal	1 932 931	—	202 368	—
ital	1 201 396	—	245 591	28 931
F.S.	1 215 056	112	10 212	3 755
ghveld	1 880 075	—	111 726	6 645
stern Transvaal	1 084 833	640	43 520	65 091
anskei	1 252	6 233	—	1 186 696
skei	—	—	—	203 909
phuthatswana	—	—	—	384 384
sotho Qua Qua	—	73	—	6 242
aZulu	40 599	385	302	1 307 425
nda	—	5	—	100 562
zankulu	—	32	—	121 603
bowa	—	—	—	435 498
tal	8 479 070	7 487	646 136	3 853 557

ENTSTOF-VERKOPE/VACCINE SALES 1959–1974



Graph showing the total annual issue of vaccines by Onderstepoort from 1959 tot 1974

and one was an invited guest lecturer in Brazil.

A specimen submitted for typing from Botswana contained the Type 9 strain of horsesickness virus, whereas one of 2 specimens from Swaziland harboured the Type 6 strain, the other being negative for horsesickness.

Vaccines supplied

The following vaccines were supplied to overseas countries:

Belgium	55
Hong Kong ..	400
Israel	30 000
Mauritius	300
St. Helena	2 100
Total	32 855

Roughly 5,2% of the vaccines produced by Onderstepoort was sold beyond our borders, chiefly to African countries.

Study tours and official visits

During the past year 4 scientists from the Institute paid short visits to overseas countries for study purposes

The Director of the Division of Veterinary Services, Dr P.R. Mansvelt, visited Paris to attend the annual meeting of the Office International des Epizooties from 13 to 18 May 1974. In October 1973 Dr Mansvelt visited London at the invitation of the Burroughs Wellcome Foundation, in order to attend the opening of that organisation's foot-and-mouth disease research institute.

Dr J.B.H. Viljoen, Deputy Director, Division of Veterinary Services, visited Britain, Belgium and Italy from 25 May to 1 June 1974. In the course of his visit he held discussions on the requirements with regard to the export of meat and meat products to those countries.

Dr J.P. van der Merwe, Deputy Director, Division of Veterinary Services, and Dr E.B. Kluge, Assistant Director, Division of Veterinary Services, attended discussions with representatives from Mozambique and Rhodesia at Massangena, Mozambique, in respect of the management and results of the 1973 tsetse spray campaign in Mozambique.

8. Agricultural Engineering

THE TESTING OF AGRICULTURAL IMPLEMENTS AND EQUIPMENT

Test reports on the following series of implements were published during the year under review:

12 hammer mills, 3 disc ploughs and 7 subsoilers.

As usual, each series of reports was accompanied by an introductory article containing information for farmers on the choice and use of the machines.

A total of eight series of reports have now been published.

A further 15 test programmes, which are in various stages of progress, include series dealing with the following implements and equipment:

Disc harrows, chisel ploughs, multi-tine subsoilers, vineyard sprayers, pick-up balers, feed mixers, agricultural fans, single-kernel planters (retest), seedkiller bins, silage harvesters, sprinklers, micro-pipes for irrigation, various drip irrigation equipment and pumps. The testing of planters (retest), disc harrows, pick-up balers, vineyard sprayers and agricultural fans has already been completed and reports are being drawn up.

Pilot tests are being carried out with orchard pruning machines.

A test was also done on a milking machine pulsator and a report on it was drawn up.

Excellent co-operation was once again received from all the implement manufacturers and distributors concerned. This is a factor of vital importance to the success of the enterprise.

AGRICULTURAL MECHANISATION DEVELOPMENT

The planning of agricultural mechanisation

A simple graphical method of mechanisation planning was developed by the Division's staff in the Highveld Region. It is attracting a great deal of attention among farmers, distributors of agricultural implements and agricultural engineering extension officers. The method has also already been included in the syllabuses of colleges of agriculture.

Cotton pickers

The operation and efficiency of the most important cotton pickers in use in the Transvaal were determined by field studies. Important findings resulted and these are set out in unpublished reports.

Combine harvester surveys

An extensive study of grain combine harvesters was undertaken in the more important summer rainfall areas. The findings are at present being summarised in reports and will also be written up as information bulletins for interested bodies.

Aluminium milk tankers

The use of lighter aluminium milk tankers in place of the usual ones of heavier stainless steel was investigated and a report containing recommendations was submitted to the provincial authorities. All doubts about the use of aluminium for this purpose have now been removed.

Automatic milking parlour door

A milking parlour door which opens and closes automatically was developed with a view to labour saving and is now being tested on a farm.

The wine industry

Various aspects of wine production were investigated in collaboration with the Oenological and Viticultural Research Institute.

- An American wine press was tested under various S.A. conditions and oenologically evaluated. The findings, as contained in a preliminary report, were satisfactory throughout. The extra flow that the press promises to give in specific circumstances could increase cellar incomes significantly — by as much as R35 000 in the case of the Steen and Colombar cultivars.
- In tests a South African crusher gave a maximum output of 53 tons per hectare with a destemming efficiency of 94 per cent, the highest found to date in tests.
- Heat treatment equipment for use in the making of red wine was investigated and a report compiled. The study provides useful information for future designs.
- Mechanical harvesting of wine grapes — Information was collected on the availability and cost of manual labour in certain wine-growing

A trial was conducted by the Division to determine the distribution of droplet sizes during sprinkler irrigation, as well as evaporation losses between the sprinkler and the ground. Use was made of permanganate of potash powder on blotting paper, which coloured the paper when moistened



areas. The capital and running costs of the machines were calculated as estimated for South African conditions and a comparison was made between manual and mechanical harvesting methods.

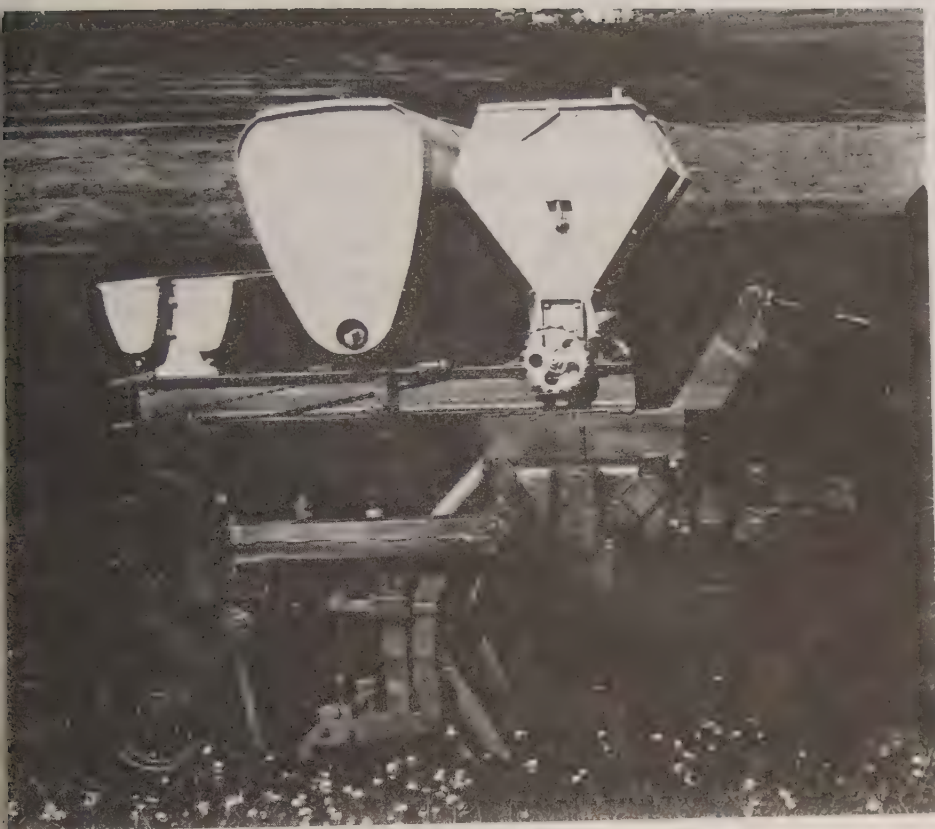
A report, "A study of the mechanical harvesting of grapes for the wine industry", was drawn up.

It is expected that mechanical harvesting machines for wine grapes will be available in South Africa by the 1975 pressing season and it is intended that evaluations of the machines should be made in co-operation with firms.

The fruit industry

Various investigations were undertaken in collaboration with the Fruit and Fruit Technology Research Institute, the control boards concerned and other related organisations.

- *Cooling of plums:* A cardboard container developed by the Deciduous Fruit Board was compared with the conventional wooden container.
- *Ripening of pears:* Preliminary results indicate that even reopening of pears is directly related to the



The pasture sowing machine developed by the Engineering Section and the Pasture Section at Cedara. It is used for enriching kikuyu pastures with legume crops and other grasses and can also be used in a no-tillage system as a pasture planter

temperature distribution in the ripening chambers and that the transportation of the fruit over long distances from cold stores to ripening chambers in the heat of the sun adds to the unevenness of the temperature.

Forced air in the cooling of fruit: The forcing of air through stacks of fruit in cold stores, either to cool it or to heat it, is being studied. Work has already been done in this connection in the U.S.A.

Dehydration tunnels: An evaluation of the performance of dehydration tunnels was undertaken. Practical tests have already been carried out on a farm near Porterville, but the tests on the Californian gas and diesel tunnels are also being continued. The possibility of using coal instead of gas or diesel oil will also be investigated.

Planning of fruit drying installations: Active assistance was given in the planning and design of a drying installation to handle 4 000 tons of fresh fruit annually for the Citrusdal Co-operative. The cost of this drying installation, which must make provision for the drying of raisins, rooibos tea and buchu over and above seven different varieties of fruit, is estimated at nearly R270 000.

The development of a device for stoning prunes mechanically is receiving attention.

FARM BUILDINGS AND STRUCTURES

The annual expenditure on farm buildings and structures in the Republic is at present estimated at more than R30 million. The rapid rise in meat prices, with the accompanying large-scale intensification of stock-farming enterprises, further underscores the importance of skilful planning of livestock housing and related farm structures.

Some of the matters considered by the Division of Agricultural Engineering, in consultation with interested persons and bodies such as Departmental livestock experts, the Meat Board and various co-operative organisations, were the following:

- The development of large-scale *cattle feeding systems*. The Division plays a leading part in the planning and development of commercial cattle feeding systems and is at present involved with projects, in collaboration with co-operatives, where about 25 000 cattle will be finished annually in each complex. The erection cost of a complex where 25 000 cattle per year can be fed and finished for the market amounts to nearly R500 000.
- *Stock waste and water pollution* in intensive stock feeding systems: The investigation into the combating of water pollution by stock waste is

progressing well. The possibility of producing methane gas from the waste matter is also receiving attention.

- Most of the livestock housing enquiries received at present concern *pig housing*. The Division is in a position to give precise guidance on this matter.
- *Methods of calf housing*: About 250 000 calves are poorly utilised in the meat market because of too early slaughtering. In its investigation into suitable methods of calf housing, the Division is trying to obtain a clear picture of the engineering principles involved in this problem. This information is at present being converted into practical recommendations on how calves can be efficiently

housed during the critical first two months, and thereafter for a further four months, in the latest intensive systems.

WATER UTILISATION

The Division's activities were almost exclusively concentrated on irrigation aspects of water utilisation, in particular the following:

Research and development

The development of Government irrigation schemes

The testing of equipment

Extension

Professional services to other Government bodies.

Reports on the testing programme, the extension work and professional services appear in the relevant chapters. The remaining items may be summarised as follows:

Research and development

- Surveys of flood irrigation of wheat were made during the year under review at the Vaalharts Government Water Scheme, and a report on the results was prepared.
- An automatic flood irrigation system was planned and installed on the Division's premises at Silverton for demonstration on mechanisation data and it is used for the information of visitors.
- A drainage investigation was carried out on the Vaalharts Government Water Scheme to determine priorities. The findings provide a basis for the construction of main drainage ditches by the Department of Water Affairs.
- An automatic evaporation pan was developed for use by farmers for irrigation scheduling. This pan can be made from an old oil drum and has two scales — the adjustable pan factor scale and the irrigation depth scale.
- A sprinkler irrigation demonstration site was laid out at Silverton to demonstrate to farmers what the locally manufactured surface sprinkle equipment looks like and how it works.

A waterway covered with polythene strips in the Winter Rainfall area where the hot rainless summers are unfavourable to the establishment of vegetal cover resistant to floodwaters





A pick-up baler is tested by researchers of the Division under farm conditions. The photograph was taken in the Weenen district

- An evaluation procedure was drawn up for the investigation of sprinkler systems and a pilot survey made. A full-scale survey was then made at the Loskop Dam Scheme and a report prepared.

Further evaluations of sprinkler systems were made in the Natal Region and in the Stellenbosch-Wellington area of the Winter Rainfall Region.

- Evaporation losses between the sprinkler and the soil were determined. Further determinations in a hot, dry area are being planned for the following summer.
- Drop-size distribution, as caused by various sprinklers, has largely been established and an empirical formula is likely to be developed shortly which will indicate the optimum pressure for specific nozzle sizes.
- Surveys were made of the wind force and direction at Douglas and an illuminating report was drawn up regarding the winds and their effect on sprinkler irrigation.
- A survey was made of drip irrigation systems in the Republic and selected systems were evaluated in order to investigate the functional efficiency of the components.

GOVERNMENT IRRIGATION SCHEMES

Makatini pilot development project — The Division's activities on this project were drastically curtailed and only 550 ha of terraced land was cleared of bush and roots.

AGRICULTURAL ENGINEERING EXTENSION

Mechanisation day

The knowledge obtained through research and development is made available to farmers and other interested persons in various ways. The highlight of the year's extension work was a most successful mechanisation day in the Division's grounds. It was attended by nearly 5 000 visitors from all over the country. Altogether 36 demonstrations and exhibitions were presented throughout the day.

The following day questions on agricultural engineering extension were discussed with about 120 Departmental extension officers and researchers. Needs in this field were identified and put into perspective.

Agricultural engineering publications

About 25 pamphlets on various aspects of agricultural engineering were produced during the year. The demand for agricultural engineering publications has increased sharply — from an average of 600 per month to about 6 000 per month at present. The record demand was 8 000 in January.

About 15 more pamphlets are with the printers and about 35 are in the process of being compiled.

Short courses, lectures and demonstrations.

A great many short courses were held and lectures and demonstrations given by staff of the Division at farmers' days, study group meetings and other gatherings throughout the country. The subjects included mechanisation planning, irrigation, tillage, winery

planning and maintenance, farm buildings, milking machines and other dairy equipment.

Run-off planning in the various regions

Programmed planning of run-off control was continued in collaboration with the regions.

Two short courses on the systematic planning of new wineries and the extension of existing ones and the handling of winery equipment were held in the Winter Rainfall Region. They were attended by 162 people representing 43 wineries. Two comprehensive manuals on this subject were also issued.

Ten requests were received for help in the planning of extensions. The Division helps with the general planning of wineries and thereafter winery managements are referred to consulting engineers, although liaison continues. The value of these extensions dealt with during the year is estimated at about R2 million.

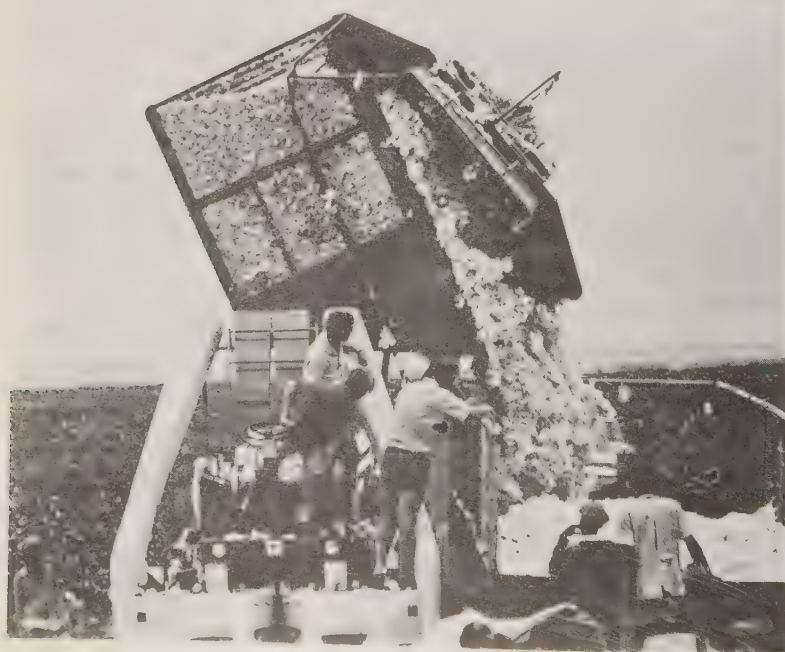
Visitors to the Division

The Division is receiving an ever-increasing number of visitors requiring information on specific subjects. The visitors include organised groups, farmers and dealers, but the most time is devoted to individual visitors.

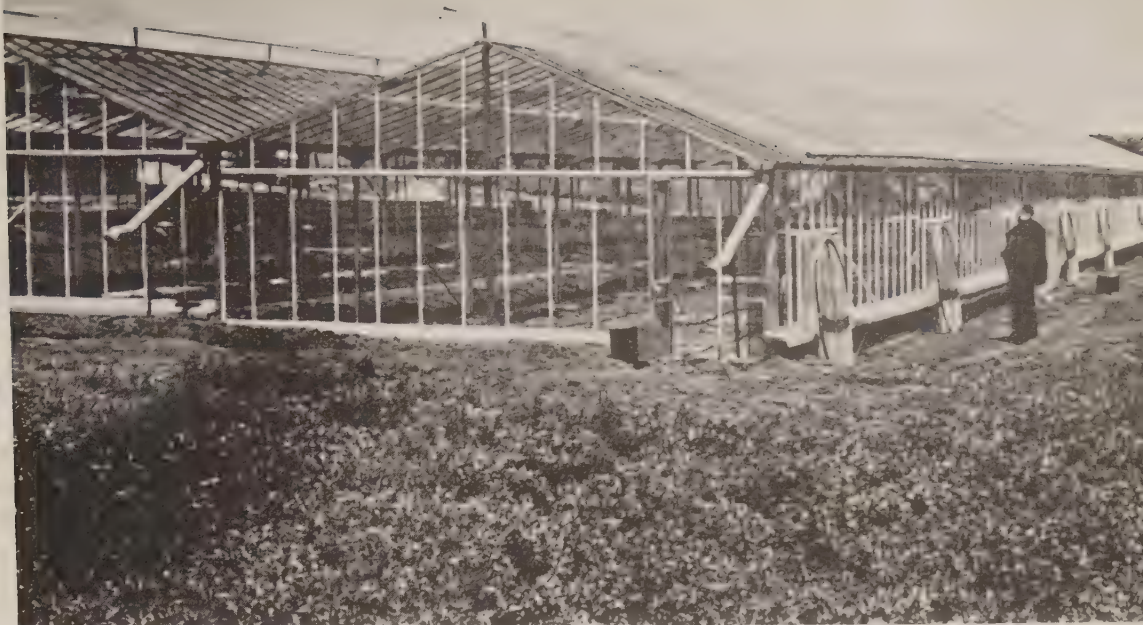
SOIL CONSERVATION

The part played by the Division of Agricultural Engineering in the Department's soil conservation campaign involves mainly run-off control planning, the establishment of larger soil conservation works, soil conservation research and various professional soil conservation engineering services in the various regions.

- *Karoo* — A further subcatchment area of the Upper Orange Catchment Area was completed, which brings the total completed to 4 subcatchment areas, i.e. 21 per cent of the 920 000 ha to be dealt with in the Karoo.
- *Eastern Cape* — The planning of the upper reaches of the Stormbergsspruit, with a total area of 210 000 ha, was completed.
- *Highveld* — One of 22 priority development areas was completely planned and 4 provisionally planned. In addition, 600 individual farms were planned in their regional context. Nearly 10 per cent of the area of the region's run-off control plans have now been completed.
- *Free State* — The planning of the Montagu Dam subcatchment in Zastron, with an area of 30 000 ha, was completed and the provisional planning for Koranaberg (65 000 ha in extent) was completed.
- *Transvaal* — A subcatchment area of the Loskop Government Water Scheme was completed as was the provisional planning of a subcatchment area of the Upper Olifants River.



Mechanization in the cotton industry: the container of a cotton picking machine is unloaded mechanically into a crate drawn by a tractor. In this way the cotton is conveyed in bulk to the gin



Efficient, hygienic cages designed by the Division for rearing calves. A minimum of labour is required to tend the calves in the cages and keep them clean

Soil Conservation Works

The design and construction of soil conservation works which are in key positions and are beyond the means of farmers are being undertaken by the Soil Conservation Works Subdivision at Aliwal North. These essential works developed from run-off control plans aimed at the stabilisation of watercourses.

Activities of the design section

Type of work	Number
Site surveys	20
Veir designs	10
Foundation inspections in detail	13

Works under construction and completed

Year	Under construction		Completed	
	Number	Value (R)	Number	Value (R)
1973/74	7	179 169	8	451 529
1972/73	9	301 830	13	765 759

Repair works under construction and completed

Year	Under construction		Completed	
	Number	Value (R)	Number	Value (R)
1973/74	5	50 085	15	84 902
1972/73	4	5 100	17	149 317

The fall-off in activities reflected in these tables is due mainly to long delays as a result of the copious rains during the second half of the year under review.

Soil conservation research

Aliwal North

The work of the research team at Aliwal North is concentrated mainly on developing techniques of erosion control for the reclamation of badly eroded valleys. Valuable findings have been made regarding sediment inclines, the establishment of vegetal cover and the use of jacks to prevent cave-ins at bends in dongas.

A noteworthy discovery is that the establishment of reeds along the bottom of sheer donga banks significantly promotes the natural levelling of the donga banks and the creation of more favourable conditions for the eventual establishment of vegetation.

Winter Rainfall Region

Because the cost of concrete and other mechanical waterways is very high in the Winter Rainfall Region with its long dry summers, the covering of waterways with polythene has been undergoing tests since 1969. This method produces satisfactory results, but some holes and tears occurred, possibly caused by sharp stones. For this reason it is recommended that the waterways should first be brought to an even finish and then covered with a layer of soil or sand. The cost of this type of lining was about one-third that of a grouted stone lining and it will be economically evaluated in about two years' time.

Natal

In Natal run-off sites were laid out to observe the effect of various types of vegetation in waterways on run-off and soil loss.

PROFESSIONAL AND TECHNICAL SERVICES

The Professional and Technical Services Subdivision is charged with providing these services for the Division itself, but also for the Department of Agricultural Technical Services as a whole and for other departments of agriculture. These services also form a large part of the work of the engineering staff attached to the regional offices and other sections of the Division.

The following summary of the more important projects carried out shows the variety and scope of these services.

Bulk storage of grain

Grain elevators for the bulk handling and storage of grain are administered mainly by co-operatives, in consultation with the Department of Agricultural Economics and Marketing, but the Director of the Division actively assists the advisory committee concerned with professional advice and supervision in the planning and construction of elevators. The grain elevator scheme is aimed at eventually making it possible to store the country's entire grain crop in elevators.

Total amount of loans for the erection of elevators during the year under review was R14 600 000 advanced by the Land Bank to agents of co-operatives and R400 000 advanced by the Treasury to private agents. With these funds 21 new projects and/or extensions to existing grain elevators were completed, together providing 824 000 m³ of storage space.

Loans totalling about R100 000 000 have already been granted for the erection of co-operative grain elevators. The completed and approved storage space amounts to more than 8 000 000 m³. It is estimated that to complete the scheme a further 6 000 000 m³ of storage space will have to be provided for which about R130 000 000 more will be needed.

Glasshouses and growth cabinets

The Division not only draws up all the plans and specifications for glasshouses, growth cabinets and related structures for the Department, but also ensures that the work is done satisfactorily. In addition, other Government departments and various private concerns are given technical assistance and advice.

This year the work included the following:

- New structures and alterations to existing structures at Departmental research institutions, including glasshouses, growth cabinets, phytotron installations and related electronic equipment.
- Assistance to the Department of Public Works in compiling specifications.
- Assistance to the Transvaal Provincial Administration in connection with glasshouses at primary schools and elsewhere.
- Assistance to the Citrus Exchange.
- Assistance to many farmers, nurserymen and other private concerns.

Experimental farm development and agricultural research

The professional services rendered by the Division on this connection to Departmental research institutions cover the whole range of agricultural mechanisation, irrigation and farm buildings. The services also include the design and manufacture of special research apparatus and implements. The following are examples of the work in this connection:



A glasshouse erected by the Division in the course of the year at one of the departmental research stations

Specifications were drawn up and assistance given in the purchase of 108 agricultural implements to the value of about R130 000 for research stations and experimental farms.

From the beginning of the year under review an engineer was seconded full-time to Onderstepoort to give professional assistance with workshop organisation, meat drying units, refrigeration plant at abattoirs and other engineering questions. Several reports containing recommendations have already been submitted to the organisations concerned.

Assistance to the Tobacco Research Institute with the bulk curing of tobacco.

Scores of irrigation projects on research stations, ranging from the design of micro-irrigation systems to the building of storage dams, were completed.

- Several buildings on experimental farms and research stations to accommodate labourers and for the housing of animals, research laboratories, dairy complexes, etc., were designed by the staff of the Division and completed under their supervision.
- Instruction at agricultural colleges in agricultural engineering subjects receives high priority. A successful three-day conference was held on agricultural engineering and one of the outcomes of this conference was the compilation of standard notes on all the relevant subjects. Most of these are ready to be printed.
- Examples of other specialised equipment made for research purposes in various fields of study were an instant green-feed apparatus, insect-isolation cages, experimental cattle crates for metabolism studies, and an automatic soil auger. In addition, various kinds of electronic apparatus were manufactured, modified and repaired.

9. Additional Services

PLANT STUDIES

Herbarium services and information

Information

A record number of more than 30 000 plant specimens were identified for research workers, farmers and other members of the public. Information was also provided on distribution, flowering and fruiting time, economic properties and other aspects of plants in South Africa. A series of popular radio talks was produced and 38 groups were shown over the herbarium collections.

Development

About 29 000 specimens were added to the herbaria of the Institute. This represents another record. Material was acquired on collecting expeditions, through exchange with herbaria in many parts of the world and through donations.

New labels for collecting, sight records and spot identifications are being developed with a view to computerisation.

New discoveries

During the numerous collecting expeditions undertaken by the herbarium staff several new species were discovered. The most striking find was plants of a new species of wild tobacco, *Nicotiana africana*, which appear to represent the first known true tobacco indigenous to Africa.

Computerisation

A start has been made with the coding of all information on the labels of the estimated 400 000 specimens of South African plants for a computerised data bank. A team of 20 encoders and 8 supervisors are presently coding about 16 000 specimens a month. Once the enormous task of converting all labels to machine-readable form has been completed, it will be possible to retrieve data on plant distribution, ecology, phenology and economics which are at present difficult or almost impossible to obtain.

South African plant names

A card index of all scientific names was compiled and more than half of it has already been converted to computer-readable form. A computer print-out of all the latest scientific grass names has already been completed.

When the names of all South African plants, which number about 16 000, are available on computer cards, it will be possible to supply a complete list to research bodies. With a view to using label data in computers, all plant species are at present being numbered.

Flora research

Flora of Southern Africa

Seven volumes are in the course of preparation:

Vol. 9. In this volume the genera *Protea* and *Serruria* are receiving attention.

Vol. 14. The genus *Crassula*, consisting of 144 species and 124 infraspecific taxa, has been revised. A field trip of 7 000 km to the Cape and South West Africa to collect material of *Adromischus*, *Cotyledon* etc. proved successful.

Vol. 15. Mimosoideae has been completed, and so has Caesalpinioideae with the exception of *Cassia*. A start was made on the tribes Dalbergieae and Sophoreae in the Papilionoideae.

Vol. 21. The treatment of Tiliaceae has been updated and brought into line with the Flora pattern. Work is still proceeding on *Hermannia* in Sterculiaceae and Malvaceae.

Vol. 22. The families Cactaceae, Turneraceae, Canellaceae and Loasaceae were completed leaving only Ochnaceae and Passifloraceae outstanding.

Vol. 25. Investigation into the minor genera *Grisebachia*, *Eremia*, *Eremiella*, *Eremiopsis* and *Platycalyx* was completed.

Vol. 33. A revision of the South West African species *Eriocephalus* was started.

To speed up work on the Flora a change in format is envisaged and will probably be effected very soon.

Grasses

The keys and generic descriptions for the new work *The Genera of Southern African Flowering Plants* were prepared. In all 189 genera were described. Full use was made of the existing literature, but original observations and special features were incorporated wherever this information was available.

The main problem to overcome was the different generic concepts adopted by different authors. Here we attempted to steer a middle course and aim for well-defined homogeneous units which are easily recognised. Excessive splitting was therefore avoided. A large number of new genera were added. Some represented newly recorded genera, while others originated as a result of splitting up hitherto non-homogeneous genera.

Eleusine indica (Land grass)

E. indica and *E. africana* are considered to represent one species. The crop grass *E. coracana*, which has been found in cave deposits from the 2nd to 3rd century A.D. in Natal, may have caused the marked variation in these species through introgressive hybridisation.

Cyperaceae

Two genera, *Ficinia* and *Mariscus*, are being studied. Characters which are employed at present to distinguish genera and species within these groups are not always reliable or meaningful. In *Ficinia* the structure of the stalk on which the fruit is borne and the surface structure of the fruit have yielded valuable distinguishing characters. In *Mariscus*, photos of pollen taken with an electron scanning microscope and a study of spikelets in a wide range of live material have afforded new insight into relationships.

Hypoxidaceae

Spiloxene is regarded as distinct from *Hypoxis*, because of differences in rootstock, hairiness, leaf arrangement, inflorescence, manner in which the anthers are borne and geographical distribution. *Pauridia*, with two species, is included in the Hypoxidaceae.

Eriosema

Population studies have resulted in the clear separation of several species of this genus commonly confused in herbaria. Widespread interspecific hybridisation causes problems in the taxonomic treatment of the group. At least two new taxa have been recognised.

Morphology of Ochnaceae

The definition of taxa was improved and a new species from the Drakensberg Series was described. *Ochna artropurpurea* appears to be a tropical species and South African plants that have hitherto been known by this name will in future be called *Ochna serrulata*.

Plectranthus and allied genera

One of the main problems has centred around the generic limits of *Plectranthus* and *Coleus*. The two have been separated in the past on the basis of the stamens being free in *Plectranthus* and united at the base in *Coleus*. This has proved to be an unsatisfactory character for separating genera and a different approach, based mainly on calyx shape, has been sought.

This has resulted in part of *Plectranthus* (mainly Asiatic species) being placed in the genus *Rabdosia*, and those *Coleus* species not incorporated in *Plectranthus* being included chiefly in *Solenostemon*. A revision on this basis of the indigenous and naturalised species in Southern Africa, dealing with 40 species of *Plectranthus* 1 of *Rabdosia* and 3 of *Solenostemon*, was prepared for publication in *Bothalia*.

Thunbergia

The scanning electron microscope has shown that hair surface structure can be used as a distinguishing character of species. In some species the stem organs above the nodes are swollen, whereas in others this swelling is not found. The stomae of the species examined do not differ very much from the point of view of structure.

Pretoria flora

Progress has been made with a semi-popular guide to the approximately 1 700 indigenous flowering plants and ferns of the Pretoria district. Identification keys and short descriptions of 1 000 species and 440 drawings have already been completed.

Genera of Southern Africa Flowering Plants

The manuscript for the Dicotyledons (Vol. 1) was completed and 2 000 pages were sent to the press. Attention was then directed to the planning of Vol. 2 on the Monocotyledons. With the co-operation of botanists both within and outside the Botanical Research Institute, progress has been very satisfactory. The completion of the manuscript is now only a matter of detail.

Bothalia

Volume 11, number 3, went to press in September 1973. The number comprises 24 articles covering taxonomy, anatomy and ecology.

Volume 43, part 1, went to press in December 1973.

Liaison Officer, Kew, England

Numerous reports were written on problems relating to the identification and classification of South African plants. Queries were received from the National Herbarium in Pretoria and regional herbaria of the Institute, from the Universities of Cape Town, Durban-Westville, Natal, Orange Free State, Pretoria, Stellenbosch and the Witwatersrand and from a number of private individuals. In addition, several queries from the Scientific Counsellor, South African Embassy, London, were dealt with.

Botanical surveys

Highveld

The eleven and twelve vegetation classes recognised respectively in the Bethlehem and Kroonstad key areas, where surveys have been completed, will now be used in extrapolating the survey to surrounding areas.

A quantitative semi-detailed survey to test methods, completed in the Lichtenburg area, showed little difference in the results obtained by different methods of classification and data reduction. The stratified-random sampling technique could have been improved by choosing sample sites representative of the physiognomic-physiographic unit being sampled. The Braun-Blanquet table method could be used to refine groups resulting from an automatic classification of vegetation.

A photograph taken on 2 July 1973 at the official opening of the new head office building of the Botanical Research Institute in the National Botanical Gardens in Pretoria. Prof. H.H. Ellenberg of Göttingen University, West Germany, is at the microphone. Behind him, from left to right, are: Dr L.E.W. Codd, Director of the Institute, who has since retired; Mr Hendrik Schoeman, Minister of Agriculture; Dr W.A. Verbeek, Secretary of the Department; and Prof. H.P. van der Schijff, Head of the Botany Department at the University of Pretoria



al cover of grassland

An experiment carried out in Pretoria showed that provided a precise definition of a "strike" is agreed upon users of the point-quadrat method, there is normally significant difference between the results obtained by different workers. However, there seems to be no way of avoiding the significant differences that are occasionally found.

Instability of basal cover continued to be apparent. Basal cover was normally highest at the end of summer and lowest in spring each year.

thern Transvaal Bushveld

General planning — Discussions were held with the Department of Planning and the Environment, the Department of Bantu Administration and Development and the Transvaal Region to determine the nature and extent of development envisaged for the bushveld region of the Northern Transvaal. The information gained will be incorporated into the design of the botanical survey programme for the region.

Ecosystem studies — The study area where the structure and function of the ecosystem was studied was situated in the *Burkea-Ochna* veld of the Nylsvlei Nature Reserve, about 10 km east of Naboomspruit.

During February and March 1974 all South African universities were visited in order to recruit possible collaborators. About 90 projects from the various research workers throughout the country were received, evaluated and submitted to the National Committee for Environmental Sciences.

Guidelines for future research were laid down at two complete workshops. It was decided that research work for 1974/75 should be directed mainly at pilot studies to enable the modellers to compile a preliminary mathematical model. This model will serve as a basis for determining research priorities.

Nylsvlei Nature Reserve — A vegetation survey of the farm Nylsvlei, 3 200 ha in extent, was carried out with the dual aim of determining the extent and the degree of homogeneity of the *Burkea-Ochna* veld in which the savannah-ecosystem project is situated, and recording the plant communities of this nature reserve as part of the country-wide vegetation inventory of permanently conserved areas.

Rustenburg Nature Reserve — A vegetation survey of the Rustenburg Nature Reserve was carried out in preparation for more extensive surveys in the Transvaal Bushveld and as part of the systematic inventory of all plant communities in permanently conserved areas. The reserve, which covers 2 896

hectares, is the only such conserved area in the Sour Bushveld of the mountainous areas in the Transvaal. Five major vegetation types, with various subdivisions, were described in terms of species composition, physiognomy and environmental features, and mapped at a scale of 1:30 000.

Braun-Blanquet method

Two courses in Braun-Blanquet phytosociological methods, attended by a total of some 50 ecologists employed by State and Provincial Departments and by Universities, were given by members of the Botanical Survey Section. The courses consisted of practical instruction in Braun-Blanquet methodology, undertaken in the Sourish Mixed Bushveld in the Naboomspruit area of the Northern Transvaal, followed by laboratory synthesis of results at the Botanical Research Institute.

The courses are aimed at instructing practising ecologists in the Braun-Blanquet method of botanical survey to enable them to participate in the unified classification of South African vegetation, a programme to be undertaken by the Botanical Research Institute in collaboration with other organisations undertaking vegetation research in South Africa.

Fynbos

(a) *Reconnaissance survey* — As a preliminary to a reconnaissance survey of the Cape fynbos to determine the major subdivisions of this veld type, relevés were made in the north-western mountain region in the Cedarberg, Porterville Mountains and the Skurweberg in the Koue Bokkeveld. The aim was to establish the scale of survey required and the degree of variation in the vegetation. All three areas showed much the same pattern of plant communities related to altitude, slope and substrata.

(b) *Cape Hangklip area* — The vegetation map of this area, the survey of which was completed last year, was drawn. The vegetation is divided into three major units, namely (i) the vegetation of the coastal plain, including littoral dunes, inland sand patches, limestone and bogs and vleis; (ii) the mountain fynbos vegetation including a few patches of temperate forest; (iii) the riparian vegetation, basically fynbos with a few scattered trees such as *Podocarpus elongatus* and *Cunonia capensis*. Invasive alien species (pest plants) occur in all these vegetation units.

(c) *Orothamnus zeyheri* — Growth measurements were continued in order to obtain information on the phenology of this very rare species. Interim proposals for the management of this species by the Department of Forestry were listed.



Veld in the Eastern Cape which has been virtually taken over by the undesirable New Zealand tussock grass *Nasella trichotoma*

Eastern Orange Free State

The results of a technique study carried out in the Clocolan and Ficksburg districts of the O.F.S. to assess the merits of different types of aerial photography for vegetation interpretation showed that colour photography gave the best results, followed by infra-red transparencies with monochrome prints last.

By means of colour aerial photography at a scale of 1:12 000, 23 grass and shrub communities in the four major topographic classes within the study area could be accurately identified.

Eichhornia crassipes (water hyacinth)

The productivity of *Eichhornia crassipes* is being studied both in the laboratory and in the field, primarily with a view to predicting and controlling its growth through nutrient removal. Results indicate that the concentration and proportions of the major nutrients K, Ca, Mg and SO_4 will not influence growth. Under natural conditions it appears that NO_3 is the primary growth limiting nutrient and PO_4 is unlikely to limit growth. Because of the high, half-saturation constant for NO_3 and the considerably lower one for PO_4 , it is probable that even under eutrophic conditions the growth of *Eichhornia* could be more readily controlled by NO_3 removal than by PO_4 removal.

Veld types of South Africa

This memoir has been updated and photographs included with a view to reprinting. Revision of the Karoo and Karroid veld types continues.

Earth resources technology satellite, ERTS-1

In co-operation with the CSIR and the United States National Aeronautics and Space Administration, images of the earth resources technology satellite (ERTS-1) were assessed for their value in determining vegetation resources and in plant ecological work. It was found that forests, dense scrub, overgrazed and eroded areas and many major veld types could be readily distinguished on the satellite images. This means that considerable savings in time are possible as regards broad regional surveys and that the satellite imagery provides an early perspective towards a more effective synthesis of field information.

The satellite images were extremely successful in recording veld fires. It will thus be possible to set up a national fire monitoring system and to relate veld fire to the veld ecology and to various human factors.

A project proposal by the Botanical Research Institute on such a monitoring system has been given preliminary approval by the American Space Agency for

next earth resources satellite to go into orbit around earth.

Economic Botany

Cancer research

A further 828 plant samples were collected and sent to the U.S.A. to be screened for activity against cancer. One of the plants screened earlier in the programme, *Putterlickia verrucosa*, has proved to be of exceptional interest and is entering clinical trials.

Nasella trichotoma

An investigation into the danger posed by this pasture weed is now nearly complete. It shows that *Nasella* is one of the most dangerous weeds to have entered South Africa and poses a threat comparable to that of jointed cactus. *Nasella* is presently thinly distributed over about 25 000 hectares, but threatens to invade a further 3 million hectares and could ultimately affect approximately 40 million hectares of the best grazing land in South Africa, if not checked.

Survival studies

Much work has been done in this relatively new field in co-operation with the South African Defence Force. A basic handbook on survival in the veld has been completed and is in printing stage. Further detailed studies are at present being undertaken in order to supplement the basic information. Lectures and practical survival courses in the veld were also undertaken.

Ethno-paleobotany

Research and routine services in this field were initiated this year. Material from four archaeological sites was studied and identified. About 400 samples coming from Mapungubwe, Bushman Rock Shelter, Kruger Cave and Shongweni Cave were identified. A lecture on the identification of such material was given to the Archaeological Society in Johannesburg.

Dioscorea sylvatica

A countrywide quantitative survey of *Dioscorea sylvatica* indicated a rapid depletion of this plant due to uncontrolled exploitation.

Part of the ecosystem study terrain in the Nylsvlei Nature Reserve near Naboomspruit



General

The year under review was one of consolidation and renewal. About half of the total area of the garden, excluding the sandstone ridge dissecting the area from east to west, is now intensively to semi-intensively developed. This situation has put a severe strain on the approximately 40 strong labour force available for the maintenance of the garden since this represents only about one labour unit per hectare of developed garden. Every effort is therefore being made to install labour-saving devices such as an irrigation system consisting of a network of pipes supplied with special valves which allows the connecting of sprinklers and the semi-automatic watering of the developed areas.

A programme of consolidation of plant beds has also been started to reduce maintenance of lawns and lawn edges. Grass cutting and soil cultivating machinery is being investigated to transfer the labour intensive methods employed at present to a more highly mechanised system.

Some areas in the garden are now reaching an age of between 15 and 20 years. In some sections, like the Cape Fynbos, this has meant the large-scale removal of moribund plants, which have to be replaced by new plantings. It will be necessary in future to replace old plants in this section gradually to avoid the extensive replanting which results in periods of distinct unattractiveness.

New developments

In order to introduce a sprinkler system, renew certain plantings and improve the layout, the cycad collection was redesigned and renovated. The paths were paved with roadstones and the collection, transferred from Vredehuis to the nursery when the herbarium moved to the new building, was incorporated in the new design. A rich, well-displayed and representative collection is now on view.

The roads system again had to receive a great deal of attention. Roads on the north side of the ridge were paved with roadstone to provide a hard surface as access to the building while the new highways south and west of the garden are being constructed. Altogether about 1 000 m of road was constructed during the year.

Planting programme

General plantings for annual display totalled about 20 000 plantlets. More permanent plantings amounted to nearly 500 plants of *Protea*, *Erica*, *Pelargonium* and *Euryops*.

A general plan outlining future development of the nursery during the next ten years was drawn up, but will need further refinement.

Two additional shadehouses 17 m by 40 m were erected, but not completed. Existing open glasshouses for the succulent collections were repaired and the roofplates renewed.

Special collections of Crassulaceae, *Cotyledon* and *Adromischus* were received during the year and are being maintained for special study. A study collection of *Mariscus* and *Pelargonium* species is being built up for study and use for publications for Flora of Southern Africa and Flowering Plants of Africa.

Records

A complete survey of the nursery containing about 28 000 plants is nearing completion. When completed a corrected record card of every introduction will be available for use by the research staff as well as for garden development. Only a limited number of surveys of sections of the outdoor plantings in the garden were undertaken.

Overall irrigation scheme

With the aid of Agricultural Engineering Services an excellent comprehensive irrigation scheme for the garden was designed. A design for a fountain near the new building was also completed, and the fountain will be installed during the coming year.

PLANT AND SEED CONTROL

Inclusion of cultivars in the Variety List

The following table shows the number of cultivars for which applications for inclusion in the Variety List were received:

Group	Number of cultivars
Field crops	56
Vegetable crops	36
Pasture crops	4
Total	96
1972/73	73
1971/72	84

Maize remained the most important kind, with applications for 36 cultivars.

The following table indicates the kinds and number of cultivars of which the names were included in the Variety List:

Kind	Number of cultivars included in the Variety List
Maize	30
Tomato	12
Grain sorghum	9
Watermelon	5
Pea	4
Gem squashes	4
Dwarf bean	3
Sweet corn	2
Soya-bean	2
Cucumber	2
Cauliflower	2
Cabbage	2
Muskmelon	1
Rough cocksfoot	1
Carrot	1
Total 1973/74	81
1972/73	60

Ninety-seven cultivar trials were carried out at various places in the Republic in order to determine the agricultural value of various maize, grain sorghum, cotton and soya-bean cultivars.

Control tests for variety trueness and purity

- (a) Control tests were carried out on 5 567 samples, of 55 kinds.
- (b) The number of samples planted out was almost 400 higher than during the previous year.
- (c) Maize, dwarf beans, tomatoes, cabbage, grain sorghum, peas and carrots were the chief kinds, and 200 or more samples per kind were planted out.

Potato performance tests

Seed potato samples are tested for variety purity and virus infection. These tests are known as performance tests. In all 1 738 samples were planted for such tests.

This method of checking on the level of disease in State-certified seed-potatoes remains the basis for determining the standard of the propagation material.

In this way poor growers and, if necessary, poor areas are eliminated. Disciplinary measures were taken against 49 growers on the basis of the test results.

Testing variety trueness and purity

In order to assist owners of seed who do not have the necessary testing facilities, a service for testing variety trueness and purity was started during 1972.

This service was initially started for tomatoes, cauliflower and cabbage.

During the past year 10 samples were tested as part of this service.

Plant breeders' rights

During the past eight years (the period during which the Act has been in operation) plant breeders' rights were applied for 64 cultivars of 25 different kinds. The largest number of cultivars of a single kind was eight (in the case of wheat).

There was a sharp rise in the number of applications received during the past two years.

Provisional plant breeders' rights have been granted for eight cultivars, but in two cases the rights have already been cancelled by the holders.

Final plant breeders' rights were granted in respect of a dwarf bean.

Breeders' plant material

Seed propagated kinds

The purification and maintenance of cultivars in order to obtain seed of a high genetic quality was continued.

Good progress was made and the following masses of breeders' seed per kind became available:

Kind	Mass (kg)
Lupins	1 950
Soya-beans	1 530
Cotton	200
Garden beans: Runner	178
Dwarf	109

The following quantities of breeders' seed of the various kinds and cultivars were issued for the production of basic seed:

Kind	Cultivar	Mass (kg)	of seed potatoes was supplied to the Potato Board for further multiplication:	
<i>(a) Vegetable crops</i>				
Beetroot	Detroit Dark Red	3,0		
Beans: Dwarf	Wintergreen	70,0		
Rummer	Witsa	70,0		
Cauliflower	Cumulus	2,5		
Cabbage	Cape Spitz	1,0		
Peas	Ranger	100,0		
Onions	Bon Accord	4,6		
	Pyramid	0,5		
	De Wildt	3,5		
	Texas Grano	0,4		
	Hojem	1,6		
Carrots	Cape Market	1,1		
Total		258,2		
<i>(b) Field crops</i>				
Cotton	Acala SJ1	100,0		
Soya-beans	Geduld	1 080,0		
Lupins	Stevens	1 950,0		
Total		3 130,0		

Cultivar	Mass
Up-to-Date	2 956 x 30 kg
King George	118 x 30 kg
Cedara	16 x 30 kg
Pentland Dell	14 x 30 kg
Total	= 3 104 x 30 kg

The multiplication of small quantities of virus-free foundation seed-potatoes of the South African bred cultivars BP1 and Vanderplank is progressing even more favourably than was expected.

The following areas are expected to be planted in the production phase during August 1974:

BP1	—	1 ha
Vanderplank	—	0,5 ha

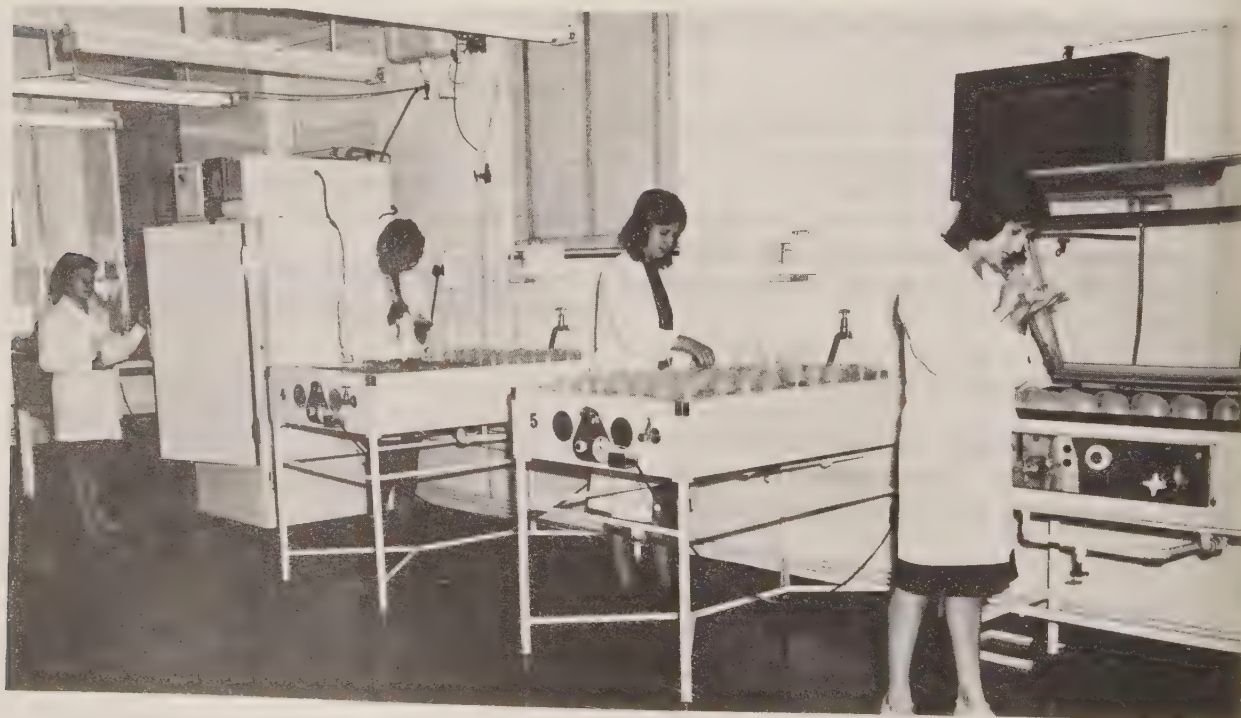
Kinds propagated vegetatively

Foundation seed-potato production

The production of foundation seed-potatoes at the Sabie foundation seed unit is still progressing well. From a planting of a little more than 5 ha the following mass

A few tubers of the promising South African bred cultivar Koos Smit have also reached the production phase.

At the entry phase small quantities of virus-free material of several South African bred cultivars are being maintained.



Germination tests with seed specimens are done with the aid of various apparatus in the seed testing laboratory of the Division of Plant and Seed Control in Pretoria

In all 490 x 30 kg of plant material was retained further multiplication at the production phase.

The Division made sufficient virus-free foundation d-potatoes available to the Potato Board for the following areas to be planted at Lydenburg:

Cultivar	Area (ha)
Up-to-Date	17,00
King George	2,50
Edara	0,50
Entland Dell	0,60
Total	20,60

Plant introduction

Good relations are being furthered and contacts built up by the frequent exchange of propagation material.

The following table shows the number of samples of plant material imported and exported by the plant production section:

	1973/ 74	1972/ 73	1971/ 72
Number of samples exported	1 969	1 222	961
Number of samples imported for local research workers	2 105	1 143	833
Number of samples imported for rust nurseries	9 019	5 472	5 928
Total	13 093	7 837	7 722

Plant gene pool

The Division of Plant and Seed Control has been entrusted with the task of seeing that genetically valuable plant material is preserved. This material is preserved in the form of seed samples or vegetative material.

Seed samples are preserved under cold, dry conditions in order to keep them viable.

Material propagated vegetatively is maintained in nurseries and orchards.

A survey on the nature and quantity of potential germ plasm material available in the Department is being carried out at present. The number of samples collected for preservation was 585.

Domestic Plant and Seed Services

Seed trade control

The number of registered sellers and cleaners of seed was 425 as against 410 the previous year; 358 were registered as sellers and 67 as cleaners.

The registered seed sellers and cleaners are distributed over the four provinces as follows:

	Trans- vaal	Cape Pro- vince	Orange Free State	Natal	Total
Sellers	141	124	58	35	358
Cleaners	33	16	8	10	67
Total	174	140	66	45	425

In all 2 622 inspections were carried out at the premises of seed sellers and cleaners, which is 8,8 per cent more than during the previous year. In order to see whether seed complies with the prescribed requirements for germination, purity, weed seed content and variety trueness, 1 547 samples from seed lots were submitted, which is 33,5 per cent more than during the previous year.

190 complaints about offenders under the Seeds Act were taken up. The results of 113 prosecutions are already known and only in three cases were the offenders found not guilty.

Sealing of lucerne seed

The following quantities of lucerne seed were approved and sealed after being found free from dodder seed and equivalent to Standard Grade:

Place where approved	Mass of seed
Oudtshoorn/Ladismith	999 700 kg
Upington	104 425 kg
Johannesburg	50 434 kg
Total	1 154 559 kg

Analysis, examination and testing of seed

The Division's seed testing station examines seed samples chiefly for purity, germination, defective seed, clean seed, weeds and moisture.

The following table shows the total number of seed samples of field crop, horticultural and forest tree species received by the Division:

Certification Scheme	Public	Under the Seeds Act			Re-search	Total
		From the seed trade	Export seed	Import seed		
5 147	4 987	1 547	92	1 863	587	14 223

The number of samples received was 2 685 lower than last year, chiefly because of the poor harvests of field crops such as maize, lupins and lucerne. The number of tests carried out therefore also dropped, to 32 365 as against 35 389 during 1972/73.

Purity and germination tests were carried out on 12 different kinds of seed for committees of the International Seed Testing Association and the results of these tests were processed statistically.

Field inspection services

Seed certification

The following schemes aimed at the production of high-quality seed are administered as part of the field inspection service:

- The Basic Seed Scheme, in terms of which basic seed for the production of certified seed under the Seed Certification Scheme and the OECD Scheme is produced;
- the S.A. Seed Certification Scheme, in terms of which variety-pure and variety-true seed of known pedigree is produced;
- the Export Seed Scheme, in terms of which basic seed only, obtained from foreign seed firms is multiplied under official supervision in the Republic, and
- the OECD Scheme for Forage Crop Seed and Oilseeds.

The following table shows the mass (kg) of seed that met the requirements of these schemes:

Crop group	Basic Seed Scheme	S.A. Seed Certification Scheme	Export Seed Scheme	OECD Scheme	Total
Vegetables	42 360	999 457	85 846	—	1 127 663
Field crops	217 417	22 187 529	—	52 500	22 457 446
Pasture crops	293	42 691	—	10 707	53 691
Total	260 070	23 229 677	85 846	63 207	23 638 800

The production of certified vegetable seed dropped by 83 633 kg since the previous year, which brings the decrease over the past two years to 442 405 kg. Drought, too much rain and the price factor are the main causes of this decrease. An increase in producer prices of seed should mean a considerable rise in future production.

During the year under review 18 004 905 kg less hybrid maize seed was certified than during the previous year. This drop of 46 per cent is ascribed to the drought conditions during the 1972/73 production season.

The following table shows the relative importance of the various sources of hybrid maize seed (according to production):

Source	1973/74	1972/73
Certified public hybrids	44%	50%
Certified private hybrids	21%	30%
Uncertified private hybrids	35%	13%

The chief white maize hybrid is still PP x K6, this hybrid was responsible for 38,54 per cent of total hybrid maize seed production. SA4(MS) and SA4 are the chief yellow hybrids and together accounted for 22,38 per cent.

The production of cotton seed increased again this year; it was 277 075 kg more than in 1972/73, which makes the total increase over the past three seasons 514 444 kg.

Powdery mildew of lupins in the Winter Rainfall Region has destroyed virtually all the seed crops. A small quantity of lupin seed, 54 450 kg, was certified. This represented only about 10 per cent of the expected crop.

The following table indicates the number of inspections carried out and the total area per crop group inspected:

Crop group	Number of inspections	Total area inspected and approved (ha)
Vegetables	1 399	2 584
Field crops	6 458	25 589
Pastures	53	1 558
Total	7 910	29 731

41 merchants and co-operatives and 704 nurserymen participated in the schemes. This number has remained constant since last year.

Seed-potato certification

"A" certificate regions

- (a) *Field screening* — In the recognised "A" area 2 931 ha was offered for certification, as against 3 648 ha last year. This is a decrease of 719 ha, which may be ascribed chiefly to the damage caused by excessive rain and floods.

114 ha was rejected, largely as a result of excessive virus infection and genetic impurity in cultivars.

- (b) *Tuber inspection* — 598 332 x 30 kg was offered for certification as against 447 198 x 30 kg pockets of seed potatoes last year. The increase was 51 134 x 30 kg. The expansion in production may be ascribed to an exceptionally keen demand for certified seed-potatoes.

79 466 x 30 kg of seed-potatoes were rejected for certification purposes, largely as a result of:

exceeding the nematode tolerance;

excessive potato tuber moth damage;

frost damage; and

exceeding the *Rhizoctonia* tolerance.

Seed-potatoes of the cultivars Up-to-Date, BP1, Vanderplank and Ilam Hardy were certified under the "AA" certificate.

"A" certificate regions

- (a) *Field screening* — 4 431 ha was offered for inspection, as against 3 971 ha last year. This is an increase of 460 ha.

Of the total offering 367 ha was rejected, chiefly because of virus diseases, inadequate

isolation from infected sources, genetic impurity in cultivars and poor physical growth conditions.

The chief cultivars planted were Up-to-Date, BP1 and Vanderplank.

- (b) *Tuber inspection* — 454 324 x 30 kg of seed-potatoes were offered for certification this year, as against 660 072 x 30 kg last year. This is a decrease of 205 748 x 30 kg. The decrease is due chiefly to good prices for table potatoes and the elimination of a few big growers of the cultivar Up-to-Date because of poor performance.

In all 25 932 x 30 kg of seed-potatoes were rejected, chiefly because of too high a level of nematode infestation, potato tuber moth or rotting of tubers.

The most important cultivars offered were Up-to-Date, BP1, Vanderplank, Ilam Hardy, King George and 890/20.

General

The cultivar Up-to-Date remains the chief cultivar for the production of State-certified seed-potatoes.

The cultivar BP1 is giving Up-to-Date keen competition and is well represented in all regions. It is foreseen that this cultivar will become more popular than Up-to-Date in the near future.

The cultivar Vanderplank is grown on a fairly large scale in the Transvaal, the Orange Free State and the Western Cape.

A fair number of new South African cultivars such as Koos Smit, R100, Lowveld Giant, Kimberley Choice and Sack Filler are being evaluated in various areas.

Plant improvement scheme

Grapes

This improvement scheme is already enjoying widespread support from nurserymen in the industry. The enthusiasm of the nurserymen and the industry is encouraging and the lead given by the organised wine industry is praiseworthy.

Parent blocks

- (a) *Rootstock parent blocks* — The establishment of rootstocks of the chief cultivars is already far advanced and a considerable quantity of material is being released to the nursery industry this winter under special certificates.

The quantity of propagation material is estimated at:

Number of scions — 692 950
Number of plant shoots — 868 300

In addition to this selected propagation material a further 288 900 rooted rootstocks are available; these will be issued for establishment during the winter of 1974.

- (b) *Scion parent blocks* — Only two blocks of the export cultivar Waltham Cross have been established so far. The establishment of parent blocks for both wine and table grape varieties was to have been speeded up during the 1974 winter months.

Cherries

This improvement scheme is still at the development stage. So far only five nurserymen are participating in the scheme — three in the Eastern Free State and two in the Western Province.

It is estimated that about 28 000 trees will be available for release to the industry. This material will be certified by the Department as "visually approved" material.

Drupes and pomes

1 131 drupe trees, chief peach, apricot and plum trees, are under continual observation as potential propagation sources.

A total of 1 604 pome trees were selected as very promising propagation sources and are remaining under observation.

Thirteen nurserymen are participating in the drupe and pome scheme. However, the scheme has not reached the same stage of development as the grape scheme.

Strawberries

This scheme has already made a considerable contribution to higher yields in the industry. Producers have nothing but praise for the Department's contribution in making virus-free material available for the industry through selected nurserymen.

The number of nurserymen was confined to six — four in the Transvaal and two in the Western Province.

Parent plants are supplied by the Department. The following table indicates the number of plants of the various cultivars planted by growers and the number certified:

Cultivar	Number of parent plants	Number certified
Selekta	26 800	323 500
Festival	7 000	67 250
Robyn	15 400	25 000
Earlibelle	23 000	19 800
Tioga	8 200	18 950
Parfaite	9 000	12 850
Torrey	6 400	12 850
Total	95 800	945 700

Rejections for certification purposes were due chiefly to nematode infestation or *Verticillium* infection.

The production of flower bulbs for export

(a) Winter bulbs

Sixteen bulb varieties, covering an area of 79,50 ha, and producing 83,10 million bulbs, were submitted for inspection. Two hectares, with a yield of 866 800 bulbs, were rejected on account of excessive virus infection.

(b) Summer bulbs

A total of 16,50 ha under nine bulb varieties, producing 2,90 million bulbs, was submitted for inspection. There were no rejections.

Pest control

Nurseries

- (a) *Registration* — The following numbers of nurseries were registered during the past two years:

Year	General nurseries	Vine nurseries
1972/73	1 452	365
1973/74	1 273	381

Of the registered general nurseries 350 were situated in the Cape Province, 208 in Natal, 658 in the Transvaal and 57 in the Free State. 273 new nurseries were registered during the past season. Owing to the keen competition several established nurseries did not re-register.

- (b) *Disease and pests* — Forty nurseries were placed under quarantine during the year under review; 28 were situated in the Transvaal and 12 in the Cape Province. Thirty-six of these nurseries have already been inspected and the quarantine has been lifted.

Quarantine was imposed mainly because of the following diseases and pests: Nematode infestation, crown gall, red scale, Ross scale, pernicious scale, white peach scale and woolly apple aphid.

Bacterial blight survey in vineyards

A total of 34 426 800 established vines were inspected to determine whether they were free of bacterial blight. These included 7 re-inspections of properties where bacterial blight previously occurred. No bacterial blight infection was found, even on the properties which were formerly infected.

Fruit inspections for scale

The dramatic drop (from 24 178 cases in 1971/72 to 5 750 in 1973/74) in the quantity of fruit rejected for the presence of scale is a proof of the success of the compulsory control of declared pests in the proclaimed districts.

Compulsory purification of orchards and cultivated plants from scale

With a view to the compulsory control of pernicious scale and grey scale, 951 spraying orders were issued in the ten proclaimed districts in the Western and South-western Cape. This includes all the important deciduous fruit producing areas. The issuing of spraying orders is not the only measure taken after infection has been established. Officers supervised spraying and 856 samples were taken for analysis to determine whether spraying had been effectively applied.

This comprehensive service includes the inspection of not only commercial fruit orchards but also domestic gardens in towns and locations.

Control inspections in the declared areas for wart disease

Control inspections were carried out on 318 plots in the municipal areas of Belfast, Hendrina, Carolina, Harrismith, Kestell and Charlestown to determine whether the provisions of the Act regarding the planting of potatoes in declared areas for wart disease are being complied with. It was found that with a few exceptions the provisions of the Act were respected. No wart disease infection was established.

Embargo on the transportation of banana plants without a permit

In order to prevent the spread of the burrowing nematode *Radopholus similis*, no one is permitted to transport or allow to be transported any banana root plant material in the Transvaal and Natal.

During the past season 97 applications for transport permits were received. Before the permits were issued, samples were taken on the plots in question in order to determine whether burrowing nematode was present. Determinations are carried out by the Citrus and Subtropical Fruit Research Institute. No burrowing nematode was found in any of the 184 samples.

International Plant and Seed Services

Seed Certification Schemes of the Organisation for Economic Co-operation and Development (OECD)

The 1973 annual meeting of representatives of certification specialists under the OECD seed schemes took place in Paris (France) from 15 to 18 October 1973. South Africa was represented at this meeting by Mr J.F. van Wyk, Director of the Division of Plant and Seed Control.

The most important decisions taken at the meeting included the following:

- (a) that it should not be compulsory to endorse the data of sampling and sealing on the label or on a container of OECD certified seed;
- (b) that a draft OECD scheme for the certification of hybrid maize seed should be prepared for consideration, and with a view to this a working group consisting of representatives of France, Canada, South Africa, the U.S.A., the EEC, the FAO and the FIS was appointed;
- (c) that a OECD seed certification scheme for annual legumes should be started;
- (d) that when judging results of post-control tests a clear distinction should be drawn between true genetic defects in the seed and poor performance owing to other causes; and
- (e) that cultivar names should not be removed from the variety list without proper and timely notice.

52 500 kg of basic seed of an overseas lupin cultivar and 10 707 kg of certified seed of two local grass cultivars were grown under the OECD Certification Scheme for Forage Crop Seed and Oilseeds.

International Seed Testing Association (ISTA)

The 17th congress of the Association took place from 17 to 22 June 1974 in Warsaw, Poland. Mr J.F. van Wyk represented the Republic and was re-elected member of the Executive Committee and elected Chairman of the Association's Seed Moisture and

Storage Committee. The Division of Plant and Seed Control is represented on the following technical committees by the officers mentioned:

- (a) Seed packing and sampling: Mr L.J. Grobler.
- (b) Germination: Mr J. Hewitt.
- (c) Purity: Mr J. Hewitt.
- (d) Statistics: Mr J. Hewitt.
- (e) Flower seed: Mr J.F. van Wyk.

European Economic Community (EEC)

Close liaison on guidelines concerning seed standards was maintained with the EEC through the Agricultural Counsellor (Economics) in Brussels.

In terms of its Resolution 74/348/EEC of 27 June 1974 the EEC granted further equivalence to certain third countries, particularly with regard to the certification of oilseeds.

Since interest has been shown in Europe in the production of seed of certain oilseed varieties in South Africa, the Republic will be obliged to apply for equivalence within the foreseeable future.

Union for the Protection of new Plant Varieties (UPOV)

On behalf of South Africa Mr J.F. van Wyk attended the 1973 board meeting of UPOV, which was held in Geneva, Switzerland, from 10 to 12 October 1973, as an observer.

A Departmental committee has investigated the desirability of South Africa's becoming a member of UPOV and has already reported on the matter.

South African exporters of cut flowers of varieties which enjoy plant breeders' rights in Europe have come under strong pressure from the European markets to persuade the South African authorities to protect those varieties in the Republic as well.

Various countries have approached the Republic with a view to concluding reciprocal agreements on the protection of plant breeders' rights. It was decided in principle to conclude such agreements, provided that they are confined to varieties which are of economic importance for South Africa.

International Plant Protection Convention (IPPC)

South Africa has been a member of the IPPC since 6 December 1951. In terms of this Convention member countries undertake to co-operate with a view to the effective prevention of the spread of diseases and pests in plants and plant products and the promotion of measures for their control. The Convention is administered by the FAO.

An *ad hoc* consultation on the IPPC took place in Rome (Italy) from 9 to 13 July 1973, with a view to revising the Convention. Mr J.F. van Wyk represented the Republic at this meeting.

SARCCUS

The Subcommittee for Seed circulated a questionnaire on progress with plant improvement, seed legislation and other related matters to member countries. The answers were incorporated in a comprehensive report submitted to the Standing Committee for Plant Production for submission to the Fourteenth General Meeting of the Commission.

International Seed Merchants' Association (FIS)

This is an international association of private seed organisations. Close liaison is maintained between the FIS and other international bodies such as the EEC, ISTA, OECD and UPOV.

The Division also maintains direct relations with the Association and so keeps pace with new theories, problems and policies in the international seed trade.

Imports and Exports of Plants, Plant Products, Seed, Bees and Bee Products

Under the Seeds Act and the Agricultural Pests Act the Division can exercise control over the quality and/or phytosanitary condition of plants, plant products (including seed), bees and bee products imported and exported. Certain standards are laid down with regard to the quality of imported seed.

As a member of the International Plant Protection Convention South Africa is involved in the world-wide campaign to control the movement over national boundaries of dangerous diseases and pests carried by plants and plant products.

bean cultivars are inspected
 registration under the Seeds
 The plantings are done on
 erimental plots of the Division
 of Plant and Seed Control



Inspection in the field for the
 certification of seed of *Eragrostis*
curvula Ermelo grass



Plants in nurseries are regularly
 inspected for diseases by officials
 of the Division of Plant and Seed
 Control

Under the Agricultural Pests Act certain provisions are laid down with regard to the phytosanitary condition of such material which is imported into the Republic, and importation is subject to a plant import permit in which the requirements are stated. As proof that the imported material meets the requirements, a phytosanitary certificate issued by the authority in the exporting country must accompany the consignment.

Similarly the Division issues phytosanitary certificates for export material in respect of which certain phytosanitary requirements are laid down by the importing country.

The following particulars reflect the important part the Division plays in ensuring the quality and phytosanitary condition of plants and plant products that are imported and exported:

Import control

Control over the quality of imported seed

All imported seed of kinds declared under the Seeds Act is subject to quality control.

The total mass of seed of declared kinds imported for all planting purposes increased by 23,72 per cent, to 4 101 132 kg. Of this mass 122 862 kg was imported for special purposes such as experimental work, canning, re-export, use as basic and parent seed, and 3 978 270 kg was intended for sale in the seed trade in the normal way.

The importation of grain sorghum, maize and pea seeds and the seeds of vegetables such as garden beet, onions, spinach-beet, cucumbers, gem squashes, carrots and sweet corn increased considerably.

On the basis of the mass of seed imported, the various crop groups represented the following

percentages: (figures for the previous two years are given as well).

Crop group	1973/74	1972/73	1971/72
	%	%	%
Vegetables	42,99	38,18	22,38
Field crops	39,22	29,66	53,16
Forage	16,36	30,64	22,19
Forage legumes	1,43	1,52	2,27

1 865 samples of imported seed were taken and submitted for the determination of purity, germination and weed seed content. The largest quantity and the biggest variety of seed were imported by Durban followed by Cape Town, Pretoria, East London, Port Elizabeth, Johannesburg, Bethal and Lourenco Marques.

The following percentages of the total mass of imported seed were rejected for the reasons given:

Germination too low	— 1,36 per cent
Physical purity too low	— 0,01 per cent
Weed content too high	— 0,26 per cent

Serious variety defects were found, especially in imported seed of kinds such as tomatoes, beans and peas. The quantity of imported seed that showed variety defects, expressed as a percentage of the total quantity of seed imported, was 7,11 per cent, which is about 4 per cent less than last year.

Control over the phytosanitary condition of plants, plant products, bees and bee products

The following table indicates the mass or quantities of the various kinds of imported material inspected for diseases and pests, together with the number of plant import permits relating to this mass or quantity of material:

Imported material	Mass inspected (kg)	Number of plant import permits	Imported material	Mass inspected (kg)	Number of plant import permits
Plants and cuttings	3 538 767	577	Broom-reeds	17 025	5
Bulbs, tubers and rhizomes	53 700 451	195	Beeswax	31 428	17
Potatoes (seed potatoes)	2 767 850	26	Nuts	1 420 778	—
Peat soil	164 801	19	Wood	468 059	—
Seed (declared)	1 936 505	606	Herbs, spices, etc.	4 661 332	3
Tobacco	1 314 180	32	Cut flowers (fresh/dried)	16 922	1
Fruit	57 166	32	Fibre, cane, etc.	28 374 677	4
Cotton and samples	40 763 268	413	Barley, malt	36 422 370	9
			Seed (undeclared)	17 473 064	—

Material which does not comply with the requirements is destroyed in serious cases, or the exporter is permitted to return the material to the country of origin, or to apply an effective disinfectant treatment, or to plant the material for observation under strict quarantine.

With regard to material that has to be inspected for phytosanitary purposes, there has been an increase in exports of the following kinds in particular: seed, timber, plants and cuttings, bulbs, tubers and rhizomes, cut flowers and cotton fibre.

Exported material	Mass inspected (kg)	Number of phytosanitary certificates issued
Seed (general)	44 656 202	937
Plants and cuttings	19 981 523	882
Bulbs, tubers and rhizomes	52 494 069	506
Cut flowers	1 286 150	3 054
Cottonseed	293 392 665	41
Other	4 496 504	149

The big reduction in the number of certificates issued is due to the failure of the lupin seed crop, large quantities of which are usually exported each year.

Control over the phytosanitary condition of exported plants and plant products

The following table shows the mass or quantities of exported material inspected for diseases and pests, together with the number of phytosanitary certificates issued as a result of those inspections:

Exported material	Mass inspected (kg)	Number of phytosanitary certificates issued
Potatoes (seed potatoes)	4 001 408	75
Potatoes (table)	9 369 883	316
Maize	115 963 992	306
Vegetables, etc.	12 781 557	1 529
Fruit	446 408 369	3 035
Groundnuts	42 822 069	890

The following interceptions were of great economic importance to the Republic:

- An entire shipment of timber from Singapore which was infected with the extremely dangerous termite *Coptotermes curvignathus*. This pest does not occur in the Republic. The consignment was fumigated with methyl bromide gas.
- Khapra beetle (*Trogoderma granarium*) was found on 62 consignments of spices from the Far and Middle East. Methyl bromide gas was again used for fumigation.

Inspection of exported material subject to phytosanitary control at the ports of export is carried out in close co-operation with the Division of Inspection Services of the Department of Agricultural Economics and Marketing, which is responsible for quality control.

Except in the case of a few products such as maize and groundnuts, where exports dropped as a result of drought, the quantities or masses of all other types of export material offered for inspection increased. In some cases they even doubled in comparison with the previous year.

Export control

Control over the quality of export seed

Compulsory quality control is applied only in the case of export lupin seed. No lupin seed was exported, however.

The Division also issues Orange Seed Analysis Certificates, upon request, under the International Seed Testing Regulations. Ninety-two such certificates (as against 507 the previous year) were issued in respect of 1 083 444 kg of seed, of which lucerne, *Eragrostis curvula*, teff, sunflower and serradella were the most important kinds.

NATIONAL COLLECTION OF INSECTS

General collection

Living material of the snout beetle *Apion antiquum* was collected for transmission to Australia for the biological control of the weed *Emex australis*; the Umzimkulu sector of Natal yielded exceptionally fine, long series of *Nudaurelia cytherea* and *Precis octavia sesamus*.

Over 250 routine determinations of insects were made through the General Collection during the past year.

During 1973/74 overseas taxonomists returned to the National Collection of Insects various collections of identified specimens which contain much valuable type material. Among the more important of these consignments are 480 Dynastidae from Budapest, 39 Scolytidae from Paris, 20 Chrysomelidae from Italy and 26 Thysanoptera from the British Museum (Nat. Hist.), London.

Six standardised steel collection cabinets, the first of their type to be used in a South African institution, were purchased and put into use in the General Collection during the past year. Cabinets of this type will eventually replace all the wooden cabinets at present holding the collections of the National Collection of Insects. They are fire-proof, more capacious than the types at present in use and work easily.

Termites

Termite research staff coped with 1 862 routine determinations of Isoptera during 1973/74; 1 819 of these involved classification of termite series comprising the annual increment to the National Collection of Insects and 43 were of samples, not retained, which had been submitted for naming by other institutions and persons at home or abroad.

The second of four scheduled National Survey of Isoptera (N.S.I.) trips to Rhodesia was completed during October-November 1973. The yield to the National Collection of Insects was 1 772 colony samples in 27 genera of Isoptera, approximately 35 per cent of these series being complete in both sterile and fertile castes. If 47 donated series taken in Angola, Botswana, Malawi, Mozambique, Republic of South Africa, Rhodesia, Rwanda and Zaïre are included, the aggregate termite increment to the National Collection of Insects is 1 819 colony samples in 30 genera.

As at 30 June 1974 the National Collection of Insects held 30 317 isopteran colony samples.

Among many highlights of the termite collection made during the year, the following merit especial mention:

1. A sample of *Coptotermes* Wasmann, obtained from heavily infested timber in the Durban Dockyard on 27 August 1973 by T.H. Marincowitz, was submitted for naming and proved to be *C. curvignathus* Holmgren, an Oriental termite hitherto recorded from the Malay Peninsula, Singapore, Borneo, Sarawak, Malacca, Sumatra, Burma and the Philippines. Sections of a large shipment of Meranti timber from Malaysia which was being landed in Durban were found to be very heavily attacked and disinfestation procedures were promptly applied to the entire ship and its cargo by the Division of Plant and Seed Control. If this introduction had not

been intercepted *C. curvignathus* could readily have become established ashore, the subtropical climate of Durban and the Natal coastal sectors being highly favourable.

2. The 1973 termite survey in Rhodesia yielded one series of *Coptotermes amanii* (Sjöst.) from the Lundi River basin between Triangle and Mbizi, in the Nuanetsi district: this constitutes the first record of an indigenous *Coptotermes* species occurring in a natural habitat to the south of the Central Plateau of Rhodesia.

3. Three samples of the extremely rare termitine species *Unguitermes trispinosus* Ruelle were collected during 1973 from two loci set in subtropical niches in the Umtali and Chiredzi districts of Eastern Rhodesia. Previously this taxon was known only from the small type series which had been collected in 1948 by A.E. Emerson in the tropical rainforest region adjoining the Epulu River, Zaïre;

4. Nine series of *Nasutitermes infuscatus* (Sjöst.), three of them complete with alates, were taken in the wet, subtropical Burma Valley sector, in the Umtali district. This must be one of the very few niches in Rhodesia where survival is possible for this taxon, which constructs large, spherical, arboreal nests of carton.

Scale insects

Armoured scales

Routine identifications of 37 samples of armoured scales were made for members of the public and institutions in Angola (4), Cameroon (1), the Malagasy Republic (3), the Republic of South Africa (27) and Rhodesia (2).

It was possible to undertake only one field survey. The yield was about 30 accessions, which were obtained mainly from grasses and bamboos.

In conjunction with Dr S. Takagi, Hokkaido University, Japan a study was undertaken to establish the identity of the unnamed taxon *Chionaspis simplex* Green, var. This species has now been identified as *Natalaspis formosana* (Takahashi) for which the genus *Natalaspis* Mac Gillivray has had to be resurrected. It is known to infest bamboos along the coastal sectors of Natal and the Transkei from Durban to Port St. Johns, with additional records from Mauritius, Réunion and Taiwan.

A contribution to knowledge of the family Conchaspidae has recently been finalised and was based on numerous accessions deposited in the National Collection of Insects of species of *Conchaspis* which were collected in South Africa, South West Africa, Rhodesia, Angola, Cameroon and Madagascar.

Descriptions have been prepared of five new species of Diaspididae from South Africa: two species of *Aspidiotus* and one each of *Discodiaspis*, *Entaspidiotus* and *Obtuaspis*.

The incorporation of the Brain Collection of Coleoptera in the National Collection of Insects was completed during the year under review.

Mealybugs and soft scales

Routine identifications and advice have been supplied to institutions and researchers in the Republic of South Africa as well as in Angola, Argentina, Cuba, West Germany, Florida, Greece, Italy, Kenya, Sicily, South Korea, Turkey and Uganda.

New research on the identity of a mealybug which causes serious damage to vines in the southern districts of the Cape Province has been initiated and large amounts of fresh material have been mounted.

A revision of the genus *Filippia* Targioni Tozzetti, 1958, has been completed. Six species have been dealt with, of which four, which are new to science, have been newly described and illustrated.

Work has begun on the identity of a group of four new species of soft scales that attack citrus in many parts of the world.

Locusts and grasshoppers

Involvement with the red locust *Nomadacris septemfasciata* (Serville), a tropical African flood-plain species, continued to take up the bulk of the time spent on the Orthoptera research project. Working on the assumption that it is easier and cheaper to combat this pest in its swampland breeding areas before swarming takes place, taxonomists of the National Collection undertook wide-ranging surveys throughout Africa in an effort to pinpoint all possible breeding spots and to determine the extent and nature of infestation.

Locust habitats in the remoter parts of the Caprivi, Botswana, Mozambique and Malawi were therefore investigated, but it was only in Central Mozambique, inland from Beira, that locust populations gave cause for concern and became the target for continued surveillance.

The Buzi area came up to expectation with a twelvefold upsurge and produced several swarms of nymphs in late January 1974. By March these had then moved into nearby sugar-cane fields at Mafambize, where they were subsequently sprayed, or had escaped inland towards Rhodesia.

These surveys have yielded approximately 400 specimens from various localities – a useful reference collection. A parallel collection of large Cyrtacanthacridinae species, likely to be confused with *Nomadacris*, has also been made as an aid to recognition of the pest species.

Information on red locust in South Africa was disseminated to all neighbouring SARCCUS territories.

The Southwestern Cape and the Great Karoo yielded approximately 500 grasshopper accessions. Work on determining and classifying the backlog of unsorted material is continuing and eight subfamilies of the Acrididae received attention.

New records for southern Africa are *Cohembia acuta* which comes into northern South West Africa and the Caprivi and *Chokwea bredoi* from near the Cunene River. Two species now added and hitherto not represented in the collection are *Nyassacris uvarovi* and *Karrua gracilis*.

Fruit flies

Of the routine determinations of Tephritidae undertaken for persons and other institutions during the year, the following are of more than passing interest: Two ceratitine pest species, *Pterandrus anonae* (Grah.) and *Trirhithrum coffeae* (Bez.) from Sao Tomé; *Dacus vertebratus* from Kenya and the same species from Senegal identified for the British Museum (Nat. Hist.), London, the latter a new record well round the Bulge of Africa.

The monographic revision of the Dacinae of Africa has made steady progress, and descriptions of many species have been completed. Diagnoses of genera and supplementary tables for species are under way. Some species groups have been completed.

Mites and spiders

Mite accessions during the year under review amounted to 392, and 894 identifications were made. These included the identification of specimens for Angola, Kenya, Malawi, Swaziland and Turkey. The identifications represent 100 species, of which 44 were phytoparasitic species.

During the year under review 430 specimens were collected, 314 in the course of a collecting trip in the Eastern Cape.

Six hundred and twenty-five spiders were identified for the national collection of spiders. Special attention was given to the family Thomisidae, a

phytophilous group of which 24 genera occur in South Africa.

Jewel beetles

Only one field survey was completed: Buprestidae were collected in the mountainous regions of the South-Western Cape Province and Little Karoo, the fauna of which has hitherto been very poorly represented in the National Collection of Insect. Several hundred specimens were taken, including long series of some very rare species.

The National Collection of Insect's collection of Acmaeoderini is now one of the most representative in the world.

After locating, borrowing and examining the types of 485 of about 500 species described in the literature and studying other material contained in all important collections of the tribe deposited in other institutions, a monographic revision of the Acmaeoderini now has been completed and will shortly be sent to press.

Nematodes

The national collection of nematodes was expanded during the year under review and now includes 10 720 plates, representing 51 100 specimens.

Taxonomic studies of several nematode groups are being continued. A study of the genus *Paralongidorus* has yielded two new species. A study of the genera *Telotylenchus*, *Histotylenchus* and *Uliginotylenchus* has revealed three new species. The study of the phytoparasitic genus *Rotylenchus* has been completed. Seven new species from South Africa are described in it, and a key for the 11 species that occur in South Africa is also given.

Parasitic Hymenoptera

Identifications of and research on the natural enemies of South African scale insects and mealybugs that are of actual and potential importance to agriculture continued. The collection of parasitic wasps now numbers almost 5 000 accessions.

Two major studies, namely the revision of the African species of the genus *Coccophagus* Westwood (Aphelinidae) and of the genus *Microterys* Thomson (Encyrtidae), have been completed.

Two other encyrtid genera which are parasites of diaspidine scale insects, namely *Arrhenophagus* Aurivillius and *Arrhenophageoidea* Girault have been revised after obtaining and studying specimens from various parts of the world.

The identity of *Copidosoma koehleri* Blanchard, a very important encyrtid used in the biological control of potato tuber moth, has been clarified after studying material from Argentina, Uruguay, Chile and Japan.

CONTROL OF OTHER ANIMAL PESTS

Rodents

Rodents caused no serious problems during the year under review.

Although moles appear to be a major problem, judging from the number of enquiries received, they have not reached pest numbers anywhere, as far as can be ascertained. Control by means of aluminium phosphide fumigation tablets appears to solve the problem effectively.

Present control measures against the multimammate mouse depend largely on the use of acute poisons such as zinc phosphide. Because the use of these preparations on a large scale could cause secondary poisoning of the natural enemies of the multimammate mouse, it was decided to concentrate on less dangerous preparations.

Mites

The two species that were of the greatest economic importance during the past season were *Tetranychus urticae* and *T. cinnabarinus*. *T. urticae* was collected from strawberries for the first time in South Africa this season — at Olifantsfontein near Pretoria. It was also found on tomatoes at Nelspruit for the first time.

A survey of red spider mites in commercial glasshouses at flower nurseries showed that *T. urticae* was the one that occurs most commonly on chrysanthemums and that *T. cinnabarinus* is found mostly on carnations. During the past season the latter species did a great deal of damage to cotton near Marble Hall and Groblersdal.

INSECT CONTROL AND RESEARCH

Some 150 applications for registration and/or amendments to existing registrations of insecticides, fungicides and rodenticides have been reviewed and recommended for registration under Act 36/1947.

The annual departmental publication A Guide to the Use of Pesticides and Fungicides in South Africa was updated and appeared in August 1973 (212 pages). An updated Afrikaans edition "n Handleiding vir die

gebruik van Plaagdoders en Swamdoders in Suid-Afrika" (237 pages) was published in February.

Brown locusts

The excellent rains that fell in the Karoo early in 1974 caused a very severe outbreak of brown locusts right from the beginning of the year. Critical shortages of poison, apparatus and manpower developed. What is more, roads became impassable, bridges were washed away and large parts of farms could not be reached except on foot, all of which made control more difficult.

Towards the end of the year under review the campaign had not yet been completed. Hoppers hatched out in the Sutherland district as late as 22 June 1974. At the end of May 1974 the situation was as follows:

Number of districts affected	—	51
Maximum number of control units	—	429
Maximum number of spray planes	—	5

Use of poison:

- (a) Powder — 2 500 metric tons
- (b) Liquid — 106 000 litres of concentrate

Number of swarms killed:

- (a) Hopper swarms — 151 437
- (b) Flier swarms — 35 203

Karoo caterpillar

The planning of a new research programme on the Karoo caterpillar was started. A broad biological and ecological study is planned, with the determination of the economic importance of the pest as the top priority. This basic information will serve as a background to the consideration of possible control methods.

Armyworm

Four new light traps were constructed at George, Grabouw, Vereeniging and Bethal. No further changes were made to the network.

The past year was marked by an absence of outbreaks of armyworm. The only outbreaks reported were a few minor ones in the Winter Rainfall Region. Very few moths were caught in the light traps.

American bollworm

American bollworm *Heliothis armigera* remains one of the chief insect pests of field crops in the Winter Rainfall Region. As in 1972, spring outbreaks of the pest again occurred in parts of the Winter Rainfall Region. Lupins in the Swartland and vicinity were widely infested and in isolated cases control measures had to be undertaken against infestations in wheat fields. During

the year under review late summer and autumn infestations occurred on tomatoes on the Olifants River Irrigation Scheme and on early peas in the Mossel Bay-George area.

Spring outbreaks seemed to be related to weather conditions during the preceding winter. A mild winter climate such as that of 1973 appears to favour spring outbreaks. This hypothesis has led to intensive laboratory studies on the effect of temperature on the development of this insect. These studies have revealed the following:

- (a) The pest insect completes its larval stage during a period which varies from an average of 9,5 days at 35°C and an average of 88,1 days at 12,8°C. Higher and lower temperatures lead to a higher mortality figure among the larvae.
- (b) Larvae do not develop further than the pupal stage at temperatures below 15,6°C. Pupae are able to remain in this cold-induced dormancy for a period of two years or more.
- (c) The insect completes its pupal stage in a period that varies from an average of 8,4 days at 35°C to an average of 67,1 days at 15,6°C.
- (d) In females the average length of the pupal stage is slightly less than in males.
- (e) Under short day conditions part of the population becomes dormant during the pupal stage at temperatures of 23,9°C and lower.
- (f) At temperatures above 23,9°C the effect of short day conditions is neutralised.

Forest and timber insects

The biology and ecology of *Nudaurelia cytherea*, which is regarded as one of the chief forest pests of the Western Cape, has been studied in detail with the aim of developing a more effective control programme geared to the life cycle of the insect. Life table studies were used to determine population numbers and fluctuations.

A technique has been developed for collecting specimens of pupae in the soil and eggs in the trees. The effectiveness of natural enemies and control measures was investigated and a combination of at least two methods of control is recommended. New developments in the use of the sex attractant and a bacterial insecticide.

Insects in stored products

Two insecticides that gave good results as grain protectants in tests held last year have now been

registered. This should solve most of the immediate problems.

Cryptotermes brevis, which has hitherto been confined to Durban and Port Elizabeth and vicinity, has now been discovered in furniture belonging to private home-owners in the Cape Peninsula.

Some of the infested pieces of furniture were brought to Rosebank, where they are being kept under quarantine. The wood has been examined and flier castes, nymphs and eggs have been observed. It therefore appears that *Cryptotermes brevis* is able to breed in the Cape Peninsula.

Pesticide residues

The heavy use of the insecticide endosulfan in the Groblersdal irrigation area could lead to the pollution of the rivers in the vicinity. The waters of the Olifants, Elands and Moses Rivers were therefore examined. Endosulfan was found in 4 per cent of the samples, mostly in fairly low concentrations, but in a few cases two to four micrograms of endosulfan per litre of water were found; these concentrations had caused fish mortality. The high concentration was not the result of normal agricultural use, but was caused by the erroneous pumping of concentrated endosulfan into the river.

The incidence of insecticide residues on cabbage and cauliflower has given rise to a thorough investigation into the rate at which the most commonly used insecticides break down. Experimental work conducted over two seasons showed that lindane, phorate and dimethoate break down in the way expected. High residues of these preparations on marketed cabbage and cauliflower can only be the result of incorrect use.

BENEFICIAL INSECTS

Biological control of —

Hakea

The two colonies of the snout beetle *Erytenna consputa* that were originally established in hakea stands have survived, but untimely drought has given the young colonies a serious setback. Another consignment of the beetles was obtained from Australia and new colonies are being established in the Hottentots Holland range and in the Langkloof, where there are big hakea infestations.

Despite the extremely unfavourable dry conditions, especially during the autumn months of the past two years, the moth *Carposina autologa* is still

multiplying in field cages. Efforts to breed the insect on a large scale under artificial conditions are continuing.

Another consignment of the bug *Sangarius paradoxus*, which destroys hakea seeds, was imported from Australia, but host specificity trials have not yet shown finally whether the insect is suitable for release. Efforts to breed this insect in quarantine are continuing.

St John's wort

No new candidates against the weed *Hypericum perforatum* (St John's wort) could be obtained during the past year. The gall midge *Zeuxidiplosis giardi*, which was released for the first time during 1973, became very well established on several hectares near Stellenbosch, in some places in large enough numbers to have an adverse effect on the growth and propagation of the weed.

Local parasites are causing only very low mortality among the midges. A strong colony was built up in the laboratory and infested plants were placed in new areas (Idasvallei, Paarl and Tulbagh) to establish the insect there.

The establishment of the beetle *Chrysolina gemellata* was unexpectedly successful on sparse infestations of the weed near Tulbagh. There was large-scale defoliation during spring and infested plants were found up to 80 metres from the release points.

Silverleaf bitter apple

Several consignments of insects that could possibly be used against silverleaf bitter apple *Solanum elaeagnifolium* were received from Argentina, New Mexico and Texas and tested, but, owing to a lack of host specificity, none of the insect species is at present being considered for release.

Opuntia aurantiaca

Five insect species were introduced from South America during the past year. They include the moth borers *Tucumania tapiacola*, *Cactoblastis cactorum* (several strains), *C. mundelli*, *C. bucyrus* and the lonchaeid fly *Dasiops bourquinii*. They are all being kept under quarantine conditions at Uitenhage, where studies on their host specificity have been started.

Field evaluation studies on the established jointed cactus cochineal *Dactylopius austrinus* clearly demonstrated that if correctly manipulated, the insect could prove to be of great value in the biological control of this weed.

Opuntia megacantha

The prickly pear stem weevil *Cactophagus spinolae* is still abundant and is increasing at all the release sites.

Exceptionally promising results are being obtained from releases at the Hankey Commonage where 14 338 adults were released in May 1969.

Lantana camara

Octotoma scabripennis was still established two seasons after release in a small area in the Western Transvaal. Experimental establishment of the stem borer *Plagiohammus spinipennis* was also obtained and no encapsulation of eggs by the purple variety of *Lantana camara* was observed.

Honey-bees

The beekeeping industry continues to grow in both size and importance. During the year under review a one-day symposium was organised by the industry and attended by some 300 delegates, amongst whom were overseas delegates who stopped over in South Africa on their way to an international beekeeping Congress in Argentina. One of the reasons for this is the increasing interest being shown throughout the beekeeping world in the African honey-bee *Apis mellifera adansonii*, one of two subspecies which is indigenous to South Africa. This subspecies was introduced into Brazil in 1956 for breeding work and has now acquired something of a reputation.

This general interest in *adansonii* has stimulated our beekeepers who are now showing considerable interest in the use of improved honey-bee strains. Work on the field testing of selected swarm-resistant strains was started.

Work on the testing of the basic stock is continuing. Researchers are trying to find ways of developing tests that will give a rapid and accurate reflection of strain potential. It is hoped that this will speed up the selection programme.

A provisional list of bee plants of the northern Cape and the southern half of South West Africa has been drawn up. It is based on data collected during the bee-hunting expedition to these parts in May 1973. It is not complete but does record some 35 bee plants. The research project on nectar plants is progressing well.

Two papers were presented at the one-day symposium by members of the beekeeping staff — one on nectar plants and one on honey-bee behaviour during pollination. In addition, talks on aspects of beekeeping were given to local associations and to high school pupils.

The bulletin "Beekeeping in South Africa" was published during the year, and has been well received generally.

MYCOLOGY

Identifications

During the year a total of 298 fungi were identified on a variety of host plants, on behalf of workers and organisations outside of the Plant Protection Research Institute.

Among these were the following: *Peronospora tribulina* Pass. on *Tribulus terrestris* from Vaalharts and Pretoria; *Stachybotrys parvispora* and *Pithomyces* sp. c.f. *sacchari* from onion seed; *Sphacelia* sp., the cause of sugary disease of sorghum from the Western Transvaal; *Botryosphaeria zeae* on maize from Natal; *Phytophthora cactorum* from root rot of walnuts; *Diplodia natalensis* on prickly pear from Pongola and *Macrophomina phaseolina*, the cause of "ashy stem blight" of soya-beans, from the Lydenburg district. *Leptosphaerulina arachidicola* was identified in culture from groundnut leaves from Cedara, Natal, for the first time.

The fungus *Helminthosporium maydis*, causal organism of southern corn leaf blight of maize, was identified on maize in two isolated fields in the Lydenburg district during an outbreak of this disease. This is the first record of the occurrence of this fungus in South Africa.

Good summer rains did not bring on the expected flush of mushrooms, but from the usually dry areas of the Northern Cape Province and South West Africa a number of specimens of *Terfezia pheili* were received, and its widespread and abundant occurrence was reported. Good specimens of *Choiromyces echinulatus*, another rather rare species of Tuberales not readily distinguishable from *Terfezia* on gross morphological characters, were received, also from this area. This is the second collection of this particular species that has been made.

Curatorial work

In all 93 specimens were registered in the fungus herbarium which now houses 44 931 specimens. These include dried down cultures and specimens on their natural substrata. All the species found for the first time or which are regarded as interesting or important for other reasons are included here.

Sixteen fungus cultures were received from overseas workers for identification and comparative studies with South African species, and 26 cultures were sent to foreign workers for identification or other purposes. Fifty-two herbarium specimens were sent out on loan.

Research work

Downy mildew fungi of maize and sorghum

Reports received in a questionnaire sent to all extension officers in the Transvaal, Highveld, Free State and Natal Regions indicated that early rains and low average temperatures prevailed, so that conditions were unfavourable for infection by these fungi.

These reports also indicate that only in two regions, viz. the Springbok Flats in the Transvaal and Ladysmith-Estcourt in Natal, are downy mildew diseases of maize known and considered to be of economic importance. In the main maize growing area of the country this disease is virtually unknown.

This research has shown that only three species of fungi which can cause downy mildew of maize and sorghum are known to be present in South Africa, viz. *Sclerospora graminicola*, *Sclerospora sorghi* and *Sclerospora macrospora*. Of these, *S. sorghi* seems to be the most important.

Pathogens of onions

As in the previous year, it was found that the percentage of onion seeds infected by fungi varied from 60 to 100 per cent. Most of these proved to be external contaminants only, and *Cladosporium cladosporioides*, *Alternaria alternata* and *Rhizopus cryzae* were the important species. Of the pathogenic species, *Fusarium moniliforme*, *F. equiseti*, *Botrytis allii*, *B. cinerea* and *Stemphylium botryosum*, especially the latter species, were found on most samples in small numbers of seeds borne both internally and superficially.

The important pathogen, *Alternaria porri*, the cause of *Alternaria* blotch disease of onions was found for the first time on seed from the 1973/74 crop originating from the George-Oudtshoorn area.

Moulds such as *Aspergillus flavus*, *A. niger*, *A. ochraceus* and xerophytic species such as *A. amstelodami* were again found in small numbers on most samples. These moulds may play an important part in the deterioration of the seed in storage and subsequent poor germination.

Toxin-producing fungi

Approximately 580 kg of maize was inoculated with *Fusarium moniliforme*. The cultures were harvested, dried and supplied to researchers at the Veterinary Research Institute, Onderstepoort, for toxicity trials with horses. It was shown that high doses of culture material caused a hepatotoxic syndrome in horses and donkeys, and low doses administered over

long periods caused brain lesions (leukoencephalomalacia) in horses.

A field outbreak of leukoencephalomalacia was investigated on a farm near Benoni where two horses had died. *F. moniliforme* was found to be the predominant fungus in the maize consumed by these horses. Approximately 200 kg of maize was inoculated with an isolate of *F. moniliforme* obtained from the sample of maize from Benoni. This culture material was dosed to a horse at low dosage rates and this horse developed typical leukoencephalomalacia after 89 days.

The investigation of the possible role of fungi in the aetiology of geeldikkop and other photosensitisation syndromes was continued. Contrary to expectations, widespread outbreaks of geeldikkop did not occur during the wet summer. The only significant outbreaks occurred in the vicinity of Calvinia during January 1974.

The predominant fungi isolated from a sample of *Tribulus terrestris* collected in a toxic camp near Calvinia were *Alternaria zinniae* and an unidentified pycnidial fungus. These two fungi were cultured on autoclaved *Tribulus* hay and *Tribulus* extract medium and dosed to sheep with negative results.

The fungus flora of onion seed

The Taxonomic Mycology Section of the Plant Protection Research Institute continued the survey of the seed-borne fungi and fungal pathogens of onion seed produced in South Africa. The extent of infection was found to vary considerably and the fungi most frequently found were *Cladosporium cladosporioides* and *Alternaria alternata* which are common saprophytes.

Pathogenic species of *Fusarium*, including *F. oxysporum*, the fungus which causes pink root rot of onions, were found in a fair number of the total of 60 samples of seeds examined during the year.

Other pathogens included *Botrytis allii*, *Botrytis cinerea*, *Stemphylium botryosum* and *Aspergillus niger* which were all found in fair percentages of the seed examined. The serious pathogen, *Alternaria porri*, the fungus that causes "purple blotch" of onions, was found on a small number of seeds in samples produced in part of the Little Karoo.

LEGUME RESEARCH

The most effective *Rhizobium* strains for legumes generally grown in the Republic were selected by the Plant Protection Research Institute and supplied to manufacturers of inoculant. Meticulous quality control

of the manufactured inoculants was exercised and samples of every group produced were tested. This strict testing resulted in 50 per cent of the inoculants produced by one manufacturer being rejected. One manufacturer is at present producing all his inoculants in sterilised peat and the quality compares favourably with the best in the world. A second manufacturer is also changing over to this method.

Legume inoculants that are not commercially available are supplied in small quantities to all bodies in the country that require the inoculants for experimental purposes. This year 117 inoculants for 38 different legumes were supplied for this purpose.

The value of effective inoculants was proved this year again by the very successful establishment of legume-grass pastures, especially in the Natal Region. The indications are that the farmers in this area are now convinced of the necessity of seed inoculation and further dramatic progress can be expected.

A systematic investigation has been started to determine which legumes are able to rely on inoculation for their nitrogen requirements. Researchers are also establishing whether inoculation of these plants is necessary in areas where the required rhizobia occur naturally in the soil.

AGRICULTURAL TECHNICAL RELATIONS WITH FOREIGN COUNTRIES

Co-operation with African countries

Technical assistance and advice was again freely given to neighbouring states and other African countries, following numerous requests received during the past year.

A long-term project was started, in co-operation with organisations in France. The object is to develop a cattle herd on the island of Réunion in order to enable the islanders to supply their own meat requirements.

Visitors from African countries

The following persons from African countries visited Departmental institutions during the year under review:

Mr L.P. Boundford, of the Ministry of Agriculture, Rhodesia, to make a study of the design and construction of cool rooms etc. at the Fruit and Fruit Technology Research Institute and the Division of Agricultural Engineering.

Mr J.A. Ellison, a biochemist of the Rhodesian Department of Research and Special Services, to make a study of mineral evaluations in relation to offal feeding at the Veterinary Research Institute, Onderstepoort.

Mr R. Halliwell, Chief Technical Officer, Department of Veterinary Services, Lilongwe, Malawi, to study certain laboratory techniques used at Onderstepoort, as well as the organisation of the Veterinary Research Institute.

Mr C.B. Payne, Rhodes Inyanga Experimental Station, Rusape, Rhodesia, to inspect commercial undertakings, nurseries and the quarantine station at Stellenbosch and gather information on apples, apricots and plums.

Dr J. de Morais Zamith, Head of the Commission for the Control of Tripanosomiasis (tsetse fly), Angola, to attend a meeting on tsetse fly control at the Division of Veterinary Services, Pretoria.

Mr P.A. Donovan, Acting Director, Department of Research and Specialist Services, Ministry of Agriculture, Rhodesia, for discussions with the Chief Director (Horticulture) and the Horticultural Research Institute and the Fruit and Fruit Technology Research Institute on horticultural problems, vegetable trials and cultivar testing.

Dr J. Falconer, Director of Veterinary Services, Botswana, to attend a meeting on tsetse fly control at the Division of Veterinary Services, Pretoria.

Mr D.F. Lovemore, Assistant Director of Veterinary Services, Rhodesia, to attend a meeting on tsetse fly control at the Division of Veterinary Services, Pretoria.

Dr F.C. Paisana, Director of Veterinary Services, Mozambique, to attend a meeting on tsetse fly control at the Division of Veterinary Services, Pretoria.

Visitors to African countries

The following officers visited African countries:

Mr T.H. Marincowitz of the Division of Plant Pest Control visited Mozambique to carry out a routine inspection of the sub-office at Lourenco Marques.

Mr J.P. van der Merwe and Dr E.B. Kluge of the Division of Veterinary Services visited Mozambique to attend a meeting on tsetse fly control.

Mr Q.P. Campbell, of the Animal and Dairy Science Research Institute, visited Rhodesia to judge the National Dorper Championship Show at Sinoia.

Dr J.H. de Lange and Mr A.P. Vincent, of the Citrus and Subtropical Fruit Research Institute, visited Swaziland to conduct experiments on the Ortanique citrus cultivar in the orchards of the Tambuti Estate.

Mr I.D. Hattingh, of the Crops and Pastures Institute visited Swaziland to inspect experimental work in which the firm Monsanto is at present engaged. New weedkillers are being tested on sugar-cane and rice.

Dr P.A. Boyazoglu, State Veterinarian at Onderstepoort, visited Swaziland to act as speaker at the Jersey Day at Manzini.

Dr H.D. Brown and Mr J.E. Beulink, of the Plant Protection Research Institute, visited Botswana and the Caprivi Strip to conduct a survey on the red locust.

Mr R. Borstlap, Control Technician of the South West Africa Region, visited Rhodesia to judge Simmentaler cattle at the Salisbury Show.

Dr D.J. Rossouw, of the Crops and Pastures Institute, and Dr J. van der Mey, of the Transvaal Region, visited Swaziland and Mozambique to inspect wheat cultivar trials.

Dr D. Edwards, of the Botanical Research Institute, visited Swaziland to give advice on plant ecology.

Mr R.S. Marr, of the Crops and Pastures Institute, visited Rhodesia to make a study of the pyrethrum industry.

Dr G.O. Harwin, of the Natal Region, visited Rhodesia, to attend a symposium on "More Beef from Grass".

Mr N.H.S. Pretorius, of the Plant Protection Research Institute, visited Rhodesia to observe experiments on locust control.

Dr M. Bachman of the Division, of Veterinary Services, visited Botswana to gather technical information during the aerial spraying campaign against the tsetse fly.

Dr E.B. Kluge, of the Division of Veterinary Services, visited Mozambique to attend a special meeting on the tsetse fly.

Mr C.D. Tribe and Mr H.H. Aschenborn, of the Plant Protection Research Institute, visited Rhodesia and Botswana to collect dung beetle species for the CSIRO, Australia.

Mr R. Borstlap, of the South West Africa Region, visited Rhodesia to render assistance with a course on Simmentalers.

Mr I.D. Hattingh, of the Crops and Pastures Institute, visited Rhodesia to inspect the results of the application of weedkillers.

Mr C.J. Hunlun, of the Division of Plant and Seed Control, visited Lesotho to render technical assistance with a potato trial.

SARCCUS (Southern Africa Regional Commission for the Conservation and Utilisation of the Soil)

The following officers visited member countries of SARCCUS in connection with the activities of the organisation:

Dr C.N. Macvicar, of the Soil and Irrigation Research Institute, visited Angola to attend a meeting on soil science and a symposium on irrigation problems.

Dr D.W. Immelman, Chief Director: Farm and Resources Development, visited Mozambique to attend a meeting on soil protection and land use planning.

Dr M.E.L. Buys, of the Soil and Irrigation Research Institute, to attend a meeting on climatology.

Mr J.J. Bruwer, Director of the Division of Agricultural Engineering, visited Botswana to attend a meeting on agricultural engineering.

Mr J.F. van Wyk, Director, of the Division of Plant and Seed Control, visited Angola to attend a meeting on seed.

Mr I.G. Venter, of the Plant Protection Research Institute, visited Angola and Mozambique to attend meetings on red-billed finch control.

Mr T.J. Skinner and Mr T.J. Kotzé, visited Angola to attend a meeting on veld utilisation.

Dr D.M. Scotney, of the Natal Region, visited Malawi to attend a meeting on land use planning and farming management.

Dr M.E.L. Buys, of the Soil and Irrigation Research Institute, visited Mozambique to attend a meeting of the Committee for Conservation and Land Use Planning.

Mr A.B. Bridgens, of the Crops and Pastures Institute, visited Mozambique and Lesotho to attend meetings in order to gain a knowledge of SARCCUS procedures.

Dr P.R. Mansvelt, Director, of the Division of Veterinary Services, visited Malawi to attend a meeting on animal health.

Dr J.H. Hofmeyr, Director of the Animal and Dairy Science Research Institute, visited Malawi to attend a meeting on animal production.

Professor S.A. Hulme, Chief Director: Field Husbandry, Dr D.W. Immelman, Chief Director: Farm and Resources Development and Dr J.S. van der Merwe, Deputy Director of the Division of Veterinary Services, visited Malawi to attend the 14th Annual General Meeting of SARCCUS.

Co-operation with overseas countries

Visiting scientists and other visitors

A large number of overseas agricultural scientists, dignitaries and persons interested in various agricultural activities visited the Republic during the year under review. Among them were the following persons:

The Honourable W.A. Borthwick, Minister of Conservation and Lands, Victoria, Australia, for discussions on conservation problems in respect of soil, water, animal and plant life.

Lord Drumalbyn, Minister Without Portfolio, England, visited the Fruit and Fruit Technology and Oenological and Viticultural Research Institutes.

Mr Paul Ferrand, President of the Réunion Chamber of Agriculture, and party, to inspect cattle breeding and feeding projects.

Mr U. Bambieris, a plant pathologist attached to the Waite Agricultural Research Institute, Australia, to seek advice on root pathogens.

Miss Barton, who is attached to the Veterinary Research Station at Glenfield, Australia, to gather information on the Department of Bacteriology and Diagnostics at Onderstepoort.

Mr G. Davidse, a botanist at the Missouri Botanical Gardens in the U.S.A., to collect *Trachypogon* spp. and cytological and herbarium material of other grass species.

Professor C.G.E. Downing, Director of Agricultural Mechanisation at the Canadian Department of Agriculture, to study the official testing programme for agricultural implements of the Division of Agricultural Engineering.

Mr John S. Dunn, of the New Zealand agricultural engineering university, Lincoln College, Canterbury, for discussions on the Stanhay seeder, sprinkling and other irrigation matters.

Mr A.L. Dyce, of the Division of Animal Health, McMaster Laboratories, Australia, to make a study of

the biology, habits and taxonomy of five biting gnat species.

Dr D.G. Edgar, Director of the Luakuna Animal Research Station, Hamilton, New Zealand, for discussions on eczema.

Mr Yamamoto, a plant quarantine inspector from Japan, to carry out inspections of citrus fruit intended for export to Japan.

Professor Jann of the Max Planck Institute, Germany, to give a lecture on immunochemistry.

Mrs C.Z.R.A. Khatibi, Director General of Scientific and Technological Education of the French Ministry of Higher Education, to investigate training facilities.

Professor G.E. Lamming, of Nottingham University, England, to study Karakul breeding.

Dr H.J. Lee of the CSIRO, Australia, to gather information on trace element metabolism.

Professor E.C. Maxie, of the University of California, Davis, U.S.A., to undertake research on fruit.

Mr J.A. Murison of the Department of Agriculture, New South Wales, Australia, to study research methods with regard to tropical and subtropical fruit.

Dr P.E. Parvin, of the College of Tropical Agriculture of the University of Hawaii, to make a study of proteas.

Dr M. Prevel of the IFAC, France, to gather information on banana fertilising research and leaf analysis techniques.

Mr N. Ross of the University of California, to advise officers of the Department on the pre-harvesting drop of peaches, etc.

Dr Norman Smith of the Rutgers University Research Station, Bridgeton, U.S.A., for discussions on vegetable and fruit cultivation, and irrigation matters.

Professor Tallok of Melbourne University, Australia, for discussions on growth and development and the implications for animal production.

Dr G. Wight and Dr J.H. Seed of the Ministry of Agriculture, Food and Fisheries, England, to inspect abattoirs that export meat to England.

Mr and Mrs Alexander of the CSIRO, Australia, to gather information on the growing of citrus and avocados and on plant breeding and selection.

Mr P.J. Boustead of the Tropical Products Institute, England, in connection with an investigation by the Malawian Government into the marketing of vegetables and fruit.

Dr R.E. Perdue of the Medicinal Plants Resources Laboratory of the U.S. Department of Agriculture, to collect plants for cancer research.

Dr P.N. Symmons of the Centre for Overseas Pest Research, England, for discussions on locust control.

Dr M.J. Trinick of the CSIRO, Australia, to deliver a lecture and take part in discussions on nitrogen fixation in leguminous and non-leguminous plants.

Dr D.S. Wishart, Director of Agriculture, Victoria, Australia, for discussions on education and extension work in agriculture, and on meat inspection services.

Mr Charles Griffen, a pig farmer from Iowa, U.S.A., to gather information on pig farming and tropical animal diseases.

Mr F. Hoppe, who is in charge of the agricultural programme on Radio RIAS, West Berlin, to collect material for radio programmes.

A group of Italian fruit farmers, to inspect fruit cultivation.

A group of Italian veterinarians attached to the Italian Ministry of Health, to inspect the organisation of diagnostic work and techniques.

Don Salvador Mathies of San Salvador, to gather information on cashew nuts, cotton and sugar.

A group of 40 Swiss farmers, to gather information on citrus, sugar cultivation and cattle farming.

A group of 20 Argentinian cattle farmers, to gather information on the cultivation of pasture crops, maize and sorghum.

A touring group of farmers from Corrientes, Argentina, to gather information on the cultivation of citrus and avocados, and on insects and insect control.

Congresses, Meetings and Study Tours

Mr J.F. van Wyk, Director of the Division of Plant and Seed Control, visited Italy and France during July 1973 to attend a meeting of the International Plant Protection Conference and take part in discussions on the co-ordination of the activities of the International Seed Testing Association and the International Standards Organisation. During October 1973 he visited

France again to attend a meeting of the OECD (Organisation for Economic Co-operation and Development) and Switzerland to attend a meeting of UPOV (Union for the Protection of New Plant Varieties).

Dr J. Bot, of the Plant Protection Research Institute, visited the Netherlands to attend the 7th session of the Codex Alimentarius Committee for Pest Control and the 8th session of the Committee on Pesticide Residues.

Dr P.R. Mansvelt, Director of the Division of Veterinary Services, visited France, to attend the annual congress of the OIE (International Office of Epizootic Diseases), and England (in October 1973) for the official opening of the new foot and mouth disease facilities at Pirbright.

Dr J.H. Grobler, Director of the Citrus and Subtropical Fruit Research Institute, visited Spain, Corsica and France to attend the first conference of the International Society of Citriculture and join the study tour that followed the conference.

Dr W.F.O. Marassas, of the Plant Protection Research Institute, visited the U.S.A., New Zealand and Australia to attend the 2nd International Congress of Plant Pathology and visit several research institutes to collect first-hand information on mycotoxins and photosensitisation syndromes.

Dr B.W. Strydom, of the Plant Protection Research Institute, visited Israel to attend a meeting of the committee for bacterial nomenclature and Scotland to attend the IBP Congress.

Mr H.J. van Zyl, of the Fruit and Fruit Technology Research Institute, visited England, the U.S.A., Canada and France in order to study the use of mechanical aids in fruit cultivation and plant trellising systems suitable for use with mechanical aids, and the cultivation of less familiar types of fruit with a view to diversifying the local fruit industry.

Mr R.G. Jones, of the Natal Region, visited England on a study tour in connection with the design, planning and development of a computer system for agriculture.

Dr H.S. Horneymyr, of the Animal and Dairy Science Research Institute, visited West Germany and Austria to attend the 6th symposium on energy metabolism of the EAAP, and the 24th annual congress of the European Association for Animal Production.

Dr J.H. Labuschagne, of the Animal and Dairy Science Research Institute, visited France, the Netherlands, Denmark, Belgium and Germany to attend

the annual congress of the International Dairy Federation, the dairy equipment show in Frankfurt and undertake a study tour.

Dr T.S. Kellerman, of the Veterinary Research Institute, visited the U.S.A., Australia and New Zealand to attend the 2nd International Congress on Plant Pathology and visit research institutes with a view to obtaining data on mycotoxicological research on the aetiology of geeldikkop.

Dr A.P. Schutte, of the Veterinary Research Institute, visited the U.S.A., the Netherlands, Germany, Belgium and England to gather information on the prevention of infectious causes of perinatal loss and infertility in sheep, cattle and horses and to solve problems experienced with diagnosing chlamydiosis.

Dr P.F. Fuls, of the Soil and Irrigation Research Institute, visited Israel, France and the U.S.A. to gather information on the classification of irrigable land, lysimetry, the pollution of agricultural water, the treatment of irrigable land and water with gypsum and the development of irrigation schemes.

Mr D.F. de Wet, of the Crops and Pastures Institute, visited Australia and the U.S.A. to investigate methods and systems of co-ordinating research on crops and pastures, with special emphasis on maize and cotton, and to study soya-bean production in the U.S.A.

Mr M.D.J. Greeff, of the Division of Agricultural Engineering, visited the U.S.A. to investigate stubble cultivation and other cultivation projects, in order to select suitable mechanical equipment for South Africa, study new practices in the field of driftsand control and study testing and research techniques for soil conservation implements.

Dr J.W. Snyman, of the Crops and Pastures Institute, visited the U.S.A. to investigate production techniques with a view to the mechanical harvesting of groundnuts.

Dr J.A. van Zyl and Dr C.S. du Plessis, of the Oenological and Viticultural Research Institute, visited France to attend a meeting of the OIV Subcommission on Microbiology, Analytical Methods, Oenological Treatment Methods and the Prevention of Adulteration.

Dr J. de V. Burger, of the Oenological and Viticultural Research Institute, visited Portugal, Spain, France, Italy, Austria, Germany and Switzerland to attend the 53rd General Meeting of the OIV and undertake a study tour in connection with research on viticulture and wine technology.

Mr L. Ginsburg, of the Fruit and Fruit Technology Research Institute, visited Cyprus to attend the first

international symposium on table grapes and then undertake a study tour to England to investigate post-harvesting problems in pears.

Mr D.J. Engelbrecht, of the Plant Protection Research Institute, visited Italy to attend a congress on virus diseases in vines.

Mr A.L. du Pisanie, of the Soil and Irrigation Research Institute, undertook a study tour to the U.S.A. to investigate the latest techniques and developments in the field of agricultural meteorology.

Dr H.T. Brodrick, of the Citrus and Subtropical Fruit Research Institute, visited the U.S.A. to attend the 2nd International Congress on Plant Pathology, the general meeting of the Plant Protection Commission and a course on "Phytophthora Root and Trunk Rots".

Mr T.E.H. Downes, of the Animal and Dairy Science Research Institute, visited Belgium, the Netherlands, Germany and Denmark to attend the annual meeting of the International Dairy Federation and undertake a study tour.

Dr D.W. Immelman, Chief Director: Farm and Resources Development, and Dr D.J. Agenbach, Director of the Highveld Region, visited the U.S.A., England, France and West Germany to make a study of the part area development plays in the agricultural development process.

Mr B. Lombard, of the Highveld Region, visited the U.S.A. to attend the 4th International Wheat Genetics Symposium and undertake the study tour that followed the symposium.

Dr and Mrs W.A. Verbeek accompanied the Minister of Agriculture on an official visit to England, Europe and Israel.

Dr A.J. Pienaar, Director of the Crops and Pastures Institute, visited the U.S.A. during September and October 1973 to attend the International Conference on Corn Quality and undertake a study tour on soya-bean production.

Mr R.H. Freislich, of the Division of Agricultural Engineering, visited the U.S.A. together with a mission from the Oilseeds Control Board to study the harvesting, drying and bulk storage of certain crops, particularly unshelled groundnuts.

Dr B. de Winter, Director of the Botanical Research Institute, visited England, Belgium and France to attend an international meeting on electronic data processing and visit institutes and bodies concerned with flora.

Professor S.A. Hulme, Chief Director: Crops and Pastures, visited the U.S.A., Canada, Mexico and Brazil to attend the triticales symposium and undertook a related study tour.

Dr J.W. Snyman, of the Crops and Pastures Institute, visited England, France, the Netherlands, Germany and Israel to attend the World Soya-bean Congress and undertake a study tour on oilseed production.

Dr J.G. Cloete, of the Animal and Dairy Science Research Institute, visited England, Belgium, the Netherlands, France, Denmark and Germany to attend the World Soy Protein Conference and undertake a study tour on protein research.

Dr H. Huismans, of the Veterinary Research Institute, visited the bluetongue research group at Denver, Colorado, U.S.A.

Dr E.C.G. Bedford, of the Citrus and Subtropical Fruit Research Institute, visited the U.S.A. to attend the ecological conference in Florida.

Dr J. Coetzee, of the Division of Veterinary Services, accompanied a mission sent to Belgium by the Meat Board to take part in discussions with EEC officials on the enforcement of EEC requirements at local abattoirs.

Mr P.F. du Toit, Agricultural Attaché in Australia, visited France and England to gain insight into the duties of the Agricultural Counsellors in Paris and London.

Mr J.C. Scheepers, of the Botanical Research Institute, visited the Centre d'Etudes Phytosociologiques et Ecologiques (CEPE) in France under the exchange scheme for scientists, to draw up standards for computer codification of plant-ecological observations.

Mr H.P. van Heerden, of the Plant Protection Research Institute, visited the U.S.A., England and France on a study tour for the purpose of investigating the management and organisation of overseas quarantine stations and studying phytosanitary services and measures.

Dr D. Edwards, of the Botanical Research Institute, visited the U.S.A., Brazil, England and France, to attend a symposium on "Remote Sensing of the Environment", a related symposium on the results of "Earth Resources Technology Satellite - 1" and visit space stations.

Dr A. Pini, of the Veterinary Research Institute, visited Italy, England, Spain and France to study the latest research results on pig diseases and attend the 3rd International Congress of the Veterinary Pig Society.

Mr D.J. Gouws, of the Free State Region, visited England, Germany and Italy to investigate the dyeing process and the scale of Karakul pelt dyeing.

Mr D.B. Marais, Director of the Division of Agricultural Information, visited the U.S.A., Canada, England, Germany, Belgium and the Netherlands to investigate the latest methods of disseminating information and attend the International Microfilm Conference.

Mr S.W. Walters, Chief Director: Extension and Training, visited the U.S.A., the Netherlands, Germany, France and England to study extension matters.

Dr B. v.D. Boshoff, of the Division of Agricultural Engineering, visited the U.S.A. in order to study mechanisation systems.

Mr D.C. Lourens, of the Division of Plant and Seed Control, visited Japan with a mission from the Citrus Exchange, to hold discussions on the possible relaxation of Japanese requirements with regard to red scale on South African citrus.

Dr D.M. Joubert, Director of the Transvaal Region, visited Iran, at the invitation of the Iranian Government, to investigate opportunities for closer liaison between the two countries. Portugal, England and France were also visited and certain agricultural aspects of their economies were studied.

Dr J.H.B. Viljoen, of the Division of Veterinary Services, accompanied a mission sent to Belgium, Italy and England by the Meat Board, to conduct discussions with EEC officials on the enforcement of EEC requirements at local abattoirs, and on the exporting of meat to Italy and England.

Mr P.C. Smith, of the Plant Protection Research Institute, visited Italy to attend a course for nematologists.

Mr C.E. Pettit, of the Eastern Cape Region, visited New Zealand to attend a conference of the Federation of Livestock Breeding Groups and also visited sheep and wool technological institutions in Australia.

Attendance at ACTIM Courses

A French organisation, Agence pour la Coopération Technique, Industrielle et Economique (ACTIM), offers annual short courses in France to overseas scientists capable of working at an advanced level in their field. The courses last about two and half months and are generally preceded by a course in the French language. The number of candidates admitted to such courses varies from 5 to 20 and the candidates are

selected by ACTIM itself. The organisation meets all the candidates' costs, apart from transport costs to France.

The following officers of the *Animal and Dairy Science Research Institute* were privileged to attend such courses during the year under review:

Dr J.J. Joubert: A course on poultry breeding, followed by a short study tour through France, England and the Netherlands to see poultry institutions.

Dr H. Lück: A course on the dairy industry, followed by a short study tour through France and Germany to obtain information on transporting milk in bulk containers.

Mr T.H. Kruger: A course on French beef breeds for the improvement of meat production, followed by a short study tour through France, Italy, Germany, the Netherlands and Belgium to visit artificial insemination centres and research stations.

Mr J.H. de Jongh: A course on poultry farming, followed by a short study tour through Germany, England and the Netherlands to obtain information on poultry feeding, and in particular on alternative sources of protein for poultry.

International organisations

The Department continued its active participation in the activities of the numerous international organisations on which it is represented.

Membership of the following organisations was obtained during the year under review:

International Organisation for Biological Control (IOBC)

Because the dangers of pollution of the air, soil and water are being appreciated to an increasing extent and greater emphasis is therefore being placed on the need for biological control of diseases and pests rather than chemical control, the Department considered it desirable that the following two research institutes, which are affected by the pollution question, obtain membership of this organisation:

The Plant Protection Research Institute and the Citrus and Subtropical Fruit Research Institute.

The aims of the IOBC are —

- (i) to promote the development of biological control (i.e. the use of living organisms or their products to prevent or reduce loss or damage caused by pest organisms or undesirable plants) and to promote

the application of biological control in integrated control programmes;

- (ii) to collect and evaluate scientific information on biological control and disseminate it free of charge to members;
- (iii) to arrange meetings and symposia; and
- (iv) to publish the periodical *Entomophaga* and distribute it free of charge to members.

Pea Growing Research Organisation Ltd (PGRO)

This is a private organisation which concentrates on research on the production problems of green peas and green beans. It is financed by levies paid by producers and subsidised by the British Government. All production research on these two crops in England is undertaken exclusively by PGRO and this organisation is universally recognised as the body which undertakes the most intensive research programme on peas and beans.

All members who so wish can participate in the symposia, courses and lectures offered and enjoy the full benefit of the organisation's free advisory services and publications.

Tea Research Foundation for Central Africa

This organisation is based in Malawi and has been engaged in research on tea cultivation for the past 40 years. It has therefore accumulated a great deal of information and breeding material, which are made available to members.

Since the environmental conditions in the areas of the Republic where tea is grown at present are very like those in Malawi, and the results obtained in Malawi — particularly with regard to irrigation methods — will therefore also be applicable in the Republic, the Department considered it advisable for the Citrus and Subtropical Fruit Research Institute, which is to undertake research on tea cultivation in the Republic in future, to obtain membership of the Foundation.

International Scheme for the Control of Vegetable Seed in the International Trade

This scheme falls under the Organisation for Economic Co-operation and Development (OECD) in Paris. The chief purpose of the scheme is to control the quality of vegetable seed bought and sold in the international trade.

Representation overseas

South Africa gained another agricultural representative abroad during the year under review with

the appointment, with effect from January 1974, of Mr P.F. du Toit, Agricultural Attaché in Canberra, Australia.

Buenos Aires expired. Dr J.P. Botha, who had been Agricultural Counsellor in London, retired on pension on 31 March 1974, upon reaching retiring age, and was succeeded by Mr C.S. Hawkins.

Mr G.J. Carstens replaced Mr J.C.D. Retief as Agricultural Counsellor in Buenos Aires with effect from January 1974, when Mr Retief's term of office in

The following table shows statistical particulars of the activities of the various overseas offices of the Department during the year under review:

Nature of activities	Office				
	Paris	London	Washington	Buenos Aires	Canberra
1. Visits to research institutions, farms, experimental farms, etc.	—	18	91	55	28
2. Conferences and meetings attended	29	5	14	25	2
3. Special investigations reported on	15	0	77	29	1
4. Reports and publications supplied to the Department and other organisations in the RSA	3 842	150	4 312	41	97
5. Number of visitors from South Africa to whom assistance was rendered	150	20	12	85	17
6. Number of visitors from South Africa for whom itineraries were drawn up	104	21	43	63	1
7. Interviews granted to non-South Africans	192	—	37	55	—
8. Bursary students and other South African students assisted	7	—	14	0	—
9. Plant material consigned to South Africa (number of cultivars)	272	31	2 951	88	7
10. Newsletters compiled and sent to the Department	—	6	37	2	—

ADMINISTRATIVE MATTERS

Establishment

Posts

The following table shows the number of posts in the Department at 30 June 1974, and indicates the number of vacancies in each Division, as against the corresponding period of the previous year:

Division	Authorised posts	30.6.1973		Authorised posts	30.6.1974	
		Posts vacant			Posts vacant	
		Number	%		Number	%
Administrative	145	12	8,3	155	12	7,7
Clerical	475	63	13,3	478	56	11,7
Professional	1 691	228	13,5	1 583	212	13,4
Technical	1 544	173	11,2	1 566	203	13,0
General A	86	7	8,1	86	3	3,5
General B	2 221	248	11,2	2 324	300	12,9
Non-classified	286	21	7,3	174	125	7,2
Posts additional to the authorised establishment	76	7	9,2	105	70	66,7
Total	6 524	759	11,6	6 471	981	15,2

Increase/Decrease in the number of authorised posts in the various categories over the past five years:

Division	30/6/1970	30/6/1971	30/6/1972	30/6/1973	30/6/1974	Total % increase or decrease
Administrative	123	132	135	145	155	+ 26,0
Clerical	471	468	465	475	478	+ 1,5
Professional	1 746	1 719	1 715	1 691	1 583	- 9,3
Technical	1 559	1 550	1 534	1 544	1 566	+ 0,4
General A	88	87	86	86	86	- 2,3
General B	2 277	2 239	2 296	2 221	2 324	+ 2,1
Non-classified	355	326	323	286	174	-51,0
Total	6 619	6 521	6 554	6 448	6 366	- 3,8*

N.B.: Non-classified posts do not include posts additional to the establishment

*Note: The drop in the number of authorised posts may be ascribed to the annual drop in vacancies in the entry grade as a result of the economy measures laid down by the Cabinet, the re-allocation of services to other bodies, and the application of production control techniques

General

In continuation of the Government's efforts to cut Government expenditure, the following measures aimed at limiting expansion of the establishment to the absolute minimum, stabilising the staff position and increasing manpower utilisation were put into operation on Cabinet instructions on 1 April 1974:

- (a) The vacancy percentage in the entry grades of the Department's establishment was reduced to 5 per cent on the above-mentioned date.
- (b) Except in urgent and essential *ad hoc* cases, organisational and establishment inspections by the Inspectorate have been indefinitely suspended.
- (c) The Efficiency Subdivision is continuing with the application of techniques of short-term control aimed at better utilisation of the clerical staff and adjusting the posts structure according to service requirements.
- (d) No funds for ordinary establishment expansion were allocated to the Department. Any expansion of essential posts must be met from Departmental savings.

Establishment inspections

Inspection and work study reports on the following institutions were implemented during the year under review:

- Administration Branch — Staff and General, Technical, Legal and Financial Divisions.

- Plant Protection Research Institute — general reorganisation.
- Division of Plant Pest Control and Division of Seed Control — replaced by the new Division of Plant and Seed Control.
- Division of Veterinary Services — Subdivisions of Administration and Regulatory Services, Meat Hygiene and Related Matters.

Important organisational and establishment changes

- The organisation and establishment of the Plant Protection Research Institute were adapted to changed service requirements and demands, and the Quarantine Station at Stellenbosch and the locust and finch control services were transferred from the former Division of Plant Pest Control to this Institute as of 1 July 1973.
- The Division of Seed Control and the Division of Plant Pest Control were replaced on 1 July 1973 by the new Division of Plant and Seed Control, with inspection and control services and quality control of propagation material as its chief functions.
- The virological investigation services for the Division of Plant and Seed Control's potato schemes were assigned to the Transvaal Region as of 1 July 1973.
- The co-ordination of weed and poisonous plant research on a national level and the technical advisory service on weed-killers were assigned as new functions to the Crops and Pastures Institute as of 1 July 1973.

5. A new Pest Control Subdivision was created in the Administration Branch with effect from 1 July 1974 to undertake the administration of agricultural pest control.

6. As a result of the introduction of the larger computer, the organisation and establishment of the Data Processing Subdivision in the Administration Branch were appropriately adjusted with effect from 1 July 1973.

7. The designation of the post of Chief Director: Extension and Regulatory Services was changed to Chief Director: Extension and Training as of 1 July 1973.

8. The establishment of the Division of Veterinary Services was expanded to make provision, under the Animal Slaughter, Meat and Animal Products Hygiene

Act, for the rendering of prescribed meat inspection services at the following abattoirs:

Pretoria abattoir	: 1 December 1973
Balfour abattoir	: 1 December 1973
Otavi abattoir	: 1 January 1974
Okahandja abattoir	
Imperial Cold Storage, Port Elizabeth	: 1 February 1974

9. In compliance with the Government's economy drive, 53 vacancies in the entry grades in the Professional, Technical, Clerical, General and Non-classified Divisions on the Department's establishment were abolished as of 1 April 1974.

10. The veterinary services in the Ovambo and Kavango Homelands were transferred to the Homeland Governments concerned together with the allocated Bantu stock inspection staff on 1 April 1974.

Staff gains and losses

Division	1.7.1972 – 30.6.1973			1.7.1973 – 30.6.1974		
	φ Gains	Losses*	%	φ Gains	Losses*	%
Administrative	5	12	– 140,0	7	12	– 71,4
Clerical	149	174	– 16,8	41	50	– 22,0
Professional	132	206	– 56,1	123	223	– 81,3
Technical	175	233	– 3,1	124	221	– 78,2
General A	15	17	– 13,3	9	15	– 66,7
General B	612	685	– 12,0	680	707	– 4,0
Non-classified	53	56	– 5,7	41	64	– 56,1
Total	1 141	1 383	– 21,2	1 025	1 292	– 26,0

φ By "Gains" is meant all persons gained by every Division, i.e. appointments from outside, promotions and translations from one Division to another, and transfers from other Departments

* By "Losses" is meant all persons lost by various Divisions (individually and jointly), including translations and promotions to other Division and cases where persons left the service for good, for instance resignations, deaths, retirements, abscondences and dismissals

Staff changes (senior staff)

Retirements

The following senior officers retired from the service of the the Department after a long career, on reaching the age limit:

Name	Rank	Institution to which attached	Years of service	Date of leaving the Service
Mr C.B. Balt	Senior Deputy Secretary (Administrative)	Head Office	41 years	31 December 1973
Mr J.S. Pretorius	Deputy Secretary	Head Office	45 years	31 March 1974
Dr L.E.W. Codd	Director	Botanical Research Institute	36 years	30 September 1973

Name	Rank	Institution to which attached	Years of service	Date of leaving the Service
Dr J.E. van der Plank	Director	Plant Protection Research Institute	44 years	31 August 1973
Prof. F.R. Tomlinson	Director	Transvaal Region	34 years	31 October 1973
Dr M. de Lange	Deputy Director	Veterinary Research Institute	36 years	31 December 1973
Mr J.H. Preller	Assistant Director	Highveld Region	39 years	31 October 1973
Dr E.B. Kluge	Assistant Director	Division of Veterinary Services	36 years	31 March 1974
Dr T.F. Adelaar	Assistant Director	Veterinary Research Institute	41 years	31 March 1974
Dr J.P. Botha	Agricultural Counsellor	Foreign Representative (London)	40 years	31 March 1974
Dr G.B. Laurence	Assistant Director	Animal and Dairy Science Research Institute	39 years	30 April 1974

Promotions

Name	Rank to which promoted	Institution	Date promotion became effective
Mr B.W. Viljoen	Senior Deputy Secretary (Administrative)	Head Office	1 January 1974
Mr R.W. Colenbrander	Deputy Secretary	Head Office	1 January 1974
Mr A.J. Schoonwinkel	Deputy Secretary	Head Office	1 January 1974
Mr L.J. Botha	Deputy Secretary	Head Office	1 April 1974
Dr J.G. Boyazoglu	Director (Personal)	Agricultural Counsellor, Paris	1 January 1974
Dr B. de Winter	Director	Botanical Research Institute	1 October 1973
Dr A.J. Heyns	Director (Personal)	Fruit and Fruit Technology Research Institute	1 March 1974
Dr J. de V. Burger	Director	Oenological and Viticultural Research Institute	1 March 1974
Dr J. Serfontein	Director	Division of Soil Protection	1 July 1973
Mr C.R. Baard	Deputy Director	Karoo Region	1 July 1973
Dr D.B.J. Killick	Deputy Director	Botanical Research Institute	1 October 1973
Mr A.B. Bridgens	Deputy Director	Panel of Professional Auxiliary Services	1 April 1974
Dr R.D. Bigalke	Deputy Director	Veterinary Research Institute	1 January 1974
Mr E. Verster	Assistant Director	Soil and Irrigation Research Institute	1 July 1973
Mr A.F. Kriel	Assistant Director	Winter Rainfall Region	1 July 1973
Mr J.H. Cloete	Assistant Director	Division of Soil Protection	1 July 1973
Dr J.W. Snyman	Assistant Director	Crops and Pastures Institute	1 October 1973
Dr D. Edwards	Assistant Director	Botanical Research Institute	1 October 1973
Mr L.J. Grobler	Assistant Director	Division of Plant and Seed Control	1 January 1974
Mr A.J. Cronjé	Assistant Director	Division of Plant and Seed Control	1 January 1974
Mr D.J. Engelbrecht	Assistant Director	Plant Protection Research Institute	1 October 1973
Mr H.P. van Heerden	Assistant Director	Plant Protection Research Institute	1 October 1973
Dr G.C. Dent	Assistant Director	Division of Veterinary Services	1 April 1974
Mr G.C. Green	Assistant Director	Soil and Irrigation Research Institute	1 March 1974
Dr C.M. Cameron	Assistant Director	Veterinary Research Institute	1 April 1974

Name	Rank to which promoted	Institution	Date promotion became effective
Dr C.J. Howell	Assistant Director	Veterinary Research Institute	1 April 1974
Mr G.W. Long	Assistant Director (Administrative)	Free State Region	1 August 1973
Mr C.S. de Villiers	Under-Secretary	Head Office	1 August 1973
Mr G.J. Smit	Under-Secretary	Head Office	1 August 1973
Mr A.C. Bosch	Under-Secretary	Head Office	1 November 1973
Mr V.M. Stewart	Under-Secretary	Head Office	1 January 1974
Mr J.E. Carstens	Under-Secretary	Head Office	1 April 1974
Mr P.M.A. Spreeth	Under-Secretary	Head Office	1 January 1974
Mr J.J. Lombard	Assistant Chief Accountant	Head Office	1 November 1973
Mr G.J. Carstens	Agricultural Attaché	Buenos Aires (Argentina)	1 August 1973
Mr P.F. du Toit	Agricultural Attaché	Canberra (Australia)	1 August 1973

Bursaries

The bursary scheme administered by the Department with funds donated by the various control

The following table shows the number of officers released from service for post-graduate study at local universities since 1965:

Year	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
B. Agric. (Hons)	—	21	14	16	11	8	8	14	12	6
(Inst. Agrar.)	111	149	70	35	25	37	47	40	39	31
Master's degree	2	6	5	1	—	—	—	—	1	—
Doctorate										

boards was continued during 1973/74. Bursaries are awarded for full periods of study varying from one to five years.

As regard advanced scientific training, it may be mentioned that a number of promising officers are studying overseas. The number of officers sent overseas for post-graduate study is still dropping.

The following table shows the number of bursaries granted since 1965 as well as their value:

The following table shows the number of officers who have completed their overseas studies or will

Number of bursaries				Total monetary value		Number of bursaries				Total monetary value	
New grants	Total	Studies completed	tary value of new bursaries granted (R)			New grants	Total	Studies completed	tary value of new bursaries granted (R)		
Grants up to 1965	38	107	27	45 800		Grants up to 1970	27	153	44	56 400	
Grants up to 1966	51	131	40	55 800		Grants up to 1971	29	138	23	61 600	
Grants up to 1967	45	141	35	52 000		Grants up to 1972	34	149	25	59 200	
Grants up to 1968	55	161	33	80 650		Grants up to 1973	46	170	32	98 200	
Grants up to 1969	29	157	31	40 200		Grants up to 1974	33	171	24	77 600	

This table includes bursaries granted for post-graduate study at local universities up to and including 1974. No bursaries for post-graduate study at local universities were awarded during 1974.

complete them shortly:

Year	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Number	21	12	14	4	15	3	4	4	5	5	5

Training of agricultural technicians

A sum of R5 000 was granted to 18 needy diploma course students at the various colleges of agriculture.

The training of learner technicians was transferred to the Pretoria College for Advanced Technical Education as of 4 July 1972. An induction course was arranged for the first-year learner technicians during the first semester of 1974.

10. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE OF THE DEPARTMENT

Agriculture Building, cor. Beatrix Street and
Soutpansberg Road, Private Bag X116, Pretoria, 0001.

Overhead Administrative Control

Secretary – Dr W.A. Verbeek
Senior Deputy Secretary (Professional) – Mr W. van der
Merwe
Senior Deputy Secretary (Administrative) – Mr B.W.
Viljoen
Deputy Secretary (General Auxiliary Services) – Mr R.W.
Colenbrander
Deputy Secretary (Personnel Administrative) – Mr A.J.
Schoonwinkel
Deputy Secretary (Technical and Legal Affairs) – Mr
L.J. Botha
Under-Secretary (Sundry) – Mr J.E. Carstens
Under-Secretary (Personnel Administration) – Mr
P.M.A. Spreeth
Chief Work Study Officer – Mr G.P. Kleinhans
Under-Secretary (Data Processing) – Mr G.J. Smit
Under-Secretary (Technical Administration) – Mr A.C.
Bosch
Under-Secretary (Statutory Control) – Mr C.J. Wessels
Under-Secretary (Acts and Parliamentary) – Mr C.S. de
Villiers
Under-Secretary (External Affairs) – Mr V.M. Stewart
Under-Secretary (Programme Planning and Estimates –
Mr H.F. van Zyl
Chief Accountant – Mr P.B. de Klerk
Assistant Chief Accountant – Mr P.L. Joubert
Assistant Chief Accountant (Programme Planning and
Estimates) – Mr J.J. Lombard

Directorate of Agricultural Technical Services

Chief Director (Crops and Pastures) – Prof S.A. Hulme
Chief Director (Farm and Resources Development) – Dr
D.W. Immelman
Chief Director (Horticulture) – Dr J.C. Strydom
Chief Director (Animal and Dairy Science) – Dr C.M.
van Wyk
Chief Director (Extension and Education) – Mr
S.W. Walters

Veterinary Services Branch

Chief Director (Veterinary Services) – Dr B.C. Jansen
Assistant Director (Administrative) – Mr M.D. Meyer
(Transvaal Agricultural Union Building, 281
Struben Street, Pretoria, 0002)

Panel Professional Auxiliary Services

Director – Vacant
Deputy Director (Biometry) – Vacant
Assistant Director (Biometry) – Dr J.P. Jooste
Assistant Director (Training) – Vacant
Assistant Director (General Auxiliary Services): Vacant

Crops and Pastures Institute

Director – Dr A.J. Pienaar
Deputy Director – Mr D.F. de Wet
Assistant Directors: Mr P.F.H. Clarke, Mr T.E.
Skinner, Dr D.J. Rossouw and Dr J.W. Snyman

The Institute does not itself engage in research but gives guidance to research workers engaged in research in the different regions on summer grain, winter grain, other agricultural crops, pastures and pasture crops, and co-ordinates all research in this connection. The co-ordination of weed and poisonous plants research at the national level, as well as supplying technical information in connection with weedicides, is also a function of the Institute.

Departmental Inspectorate

Departmental Inspector (Professional) – Mr H.J. Kriek
Departmental Inspector (Professional) – Vacant

(b) FOREIGN REPRESENTATIVES

Agricultural Attaché (London) – Mr C.S. Hawkins
(Agricultural Counsellor) (South African Embassy,
South Africa House, Trafalgar Square, London
W.C. 2N5DP, England)
Agricultural Attaché (Paris) – Dr J.G. Boyazoglu
(Agricultural Counsellor) (South African Embassy,
59 Quai D'Orsay, 75007, Paris, France)
Agricultural Attaché (Washington) – Dr P. Hildyard
(Agricultural Counsellor) (South African Embassy,
3051 Massachusetts Avenue, Washington D.C.
20008, U.S.A.)
Agricultural Attaché (Buenos Aires) – Mr G.J. Carstens
(South African Embassy, Avenida Marcelo T. de
Alvear 590-8 Pisco, Buenos Aires, Argentina)
Agricultural Attaché (Canberra) – Mr P.F. du Toit
(South African Embassy, Rhodes Place,
Yarrulumba, Canberra ACT 2600, Australia)

(c) RESEARCH INSTITUTES

Soil and Irrigation Research Institute,
Belvedere Street, Private Bag X79, Pretoria, 0001

Director — Dr M.C.F. du Plessis

Deputy Director (Chemical Analysis and Soil Survey and
Regulatory Services) — Dr P.F. Fuls

Deputy Director (Irrigation Research, Agricultural
Meteorology and Agricultural Land Development)
— Dr A.D. Nieuwoudt

Assistant Directors: (Chemical analysis and Regulatory
Services) — Dr C.E.G. Schutte; (Soil Survey) — Dr
C.N. Macvicar; (Irrigation Research) — Mr G.C.
Green; (Agricultural Meteorology) — Dr M.E.L.
Buys; (Agricultural Land Development) — Mr J.
Myburgh; Seconded to Agricultural Credit and
Land Tenure (Irrigation Planning) — Mr E. Verster

The Institute is responsible for the classification and
mapping of the soils of the Republic, as well as for
basic research at national level in respect of the
physical and chemical characteristics of soils. In
addition, soil surveys are undertaken for irrigation
projects and the investigation of physical soil
characteristics where brack and waterlogging
conditions occur. The Institute, on behalf of other
Government departments, provincial
administrations and other bodies, also undertakes
the chemical analysis of soil, water and plant
material. Furthermore, the Institute, in terms of
Act 36 of 1947, undertakes the inspection and
analysis of fertilisers, stock feeds, stock remedies
and agricultural remedies. The Institute is
responsible for the planning, co-ordination and
control of irrigation research carried out by and/or
in co-operation with the Regions and Institutes
and has also been designated to undertake
agricultural evaluations and planning of irrigation
areas. Another task of the Institute is the
collection, processing and interpretation of
meteorological data for agricultural purposes.

Plant Protection Research Institute,
Agriculture Building, Beatrix Street, Private Bag X134,
Pretoria, 0001

Director — Dr I.H. Wiese

Deputy Director — Dr J.J. du Toit (Director)

Assistant Director (Entomology/ Zoology) — Dr D.P.
Annecke

Assistant Director (Combating of Locusts) — Vacant

Assistant Director (Phytosanitary Services) — Mr H.P.
van Heerden

Assistant Director (Plant Pathology/Microbiology) — Dr
B.W. Strydom

The Institute is broadly responsible for advanced
research and research at the national level on plant
pathology, insect and animal pests and their
control. This includes microbiology, taxonomy of
fungi, identification of virus diseases, the freeing
of propagating material from viruses, honey-bees,
insects in stored grain, forest and timber insects,
taxonomy of insects and nematodes, economic
zoology, toxicology of insecticides and the
biological control of insect pests and weeds. The
Institute is also responsible for the examination
and control of imported plant material and the
control of migratory locusts. The Institute uses the
research stations and experimental farms at
Rietondale (Pretoria), Buffelspoort (Marikana),
Fleurbaix and the quarantine station
(Stellenbosch), as well as the research units for the
control of prickly pear and jointed cactus at
Uitenhage and forest pests at Rosebank (Cape
Town).

Botanical Research Institute,
Private Bag X101, Pretoria, 0001

Director — Dr B. de Winter

Deputy Director — Dr D.J.B. Killick

Assistant Director — Dr D. Edwards

The Institute undertakes basic research on the flora and
vegetation of South Africa with emphasis on
taxonomy, morphology, ecology and economic
botany. The Institute also controls the Botanical
Garden at Brummeria (Pretoria) and herbaria in
Durban, Grahamstown, Kimberley, Pretoria,
Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute,
Private Bag 11208, Nelspruit, 1200

Director — Dr J.H. Grobler

Deputy Director — Mr A. van Oostrum

Assistant Director — Dr D.L. Milne

The Institute is responsible for country-wide research on
all aspects of the citrus and subtropical fruit
industry, as well as nuts, tea, coffee and herbs.

The Institute also undertakes research on the research
stations and experimental farms Addo (Eastern
Cape), Burgers Hall, Citrusdal, East London,
Friedenheim, Levubu (Louis Trichardt), Messina,
and Rustenburg.

Tobacco Research Institute (Kroondal),
Private Bag, Rustenburg, 0300

Director – Mr J.F. Peens
Deputy Director – Mr H.G. Snyman (Assistant Director)
Assistant Director – Dr M.P. Lamprecht

The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research stations and experimental plots at Groblersdal, Hartbeespoort (Brits), Nelspruit, Oudtshoorn, Potgietersrus and Stellenbosch.

Horticultural Research Institute (Roodeplaat)
Private Bag X293, Pretoria, 0001

Director – Mr E. Strydom
Deputy Director – Dr J.T. Meynhardt
Assistant Director – Mr T.G. la G. Joubert

The Institute is responsible for all applied and fundamental research and extension on vegetables, cut flowers, ornamental plants and shrubs throughout the whole of South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The Institute controls the research stations for vegetables at Roodeplaat in the Transvaal Middleveld and for cherry and deciduous fruit at Emperani, near Ficksburg. In addition the Institute undertakes research on vegetables in the winter rainfall area at Elsenburg, Outeniqua and Lutzville, as well as at Glen in the Orange Free State, at Nelspruit in the Transvaal Lowveld and at Cedara in Natal. Research on indigenous flowers, mainly proteas, is undertaken at the Tygerhoek Research Station near Riviersonderend.

Veterinary Research Institute,
Onderstepoort, 0110

Director – Dr K.E. Weiss
Deputy Directors:
(Virus Diseases, Bacterial and Protozoic Diseases, Parasitology and Chemistry) – Dr R.D. Bigalke
(Pathology, propagation, and Professional Technical Auxiliary Services) – Dr J.D. Smit

Assistant Directors:
(Professional Technical Auxiliary Services) – Dr C.M. Cameron
(Pathology) – Dr J.G. Pienaar
(Parasitology and Propagation) – Dr T.W. Naudé
(Virus Diseases) – Dr D.W. Verwoerd

(Bacterial and Protozoic Diseases) – Dr C.J. Howell
(Chemistry) – Dr R. Oellermann

The Institute is concerned with research on diseases of stock and wild game (infectious and others, including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute,
Poynton Building, West Block, 9th Floor, Church Street,
Private Bag X177, Pretoria. 0001

Director – Dr J.H. Hofmeyr
Deputy Director (Livestock Improvement, Animal Physiology and Nutrition and Poultry Science) – Dr P.E. Lombard (Assistant Director)
Deputy Director (Dairy Science) – Dr J.C. Oosthuizen
Assistant Directors:
(Livestock Improvement) – Mr J.S.A. Landrey
(Animal Physiology and Nutrition) – Dr J.G. Cloete
(Poultry Science) – Mr W.J.C. Viljoen
(Dairy Science) – Dr J.H. Labuschagne

The Institute, at various centres throughout the country, undertakes at the natural level performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig testing stations at Irene, Cedara and Elsenburg, and bull testing stations at Queenstown and Omatjenne (South West Africa).

Fruit and Fruit Technology Research Institute,
Private Bag X5013, Stellenbosch, 7600

Director – Dr P.G. Marais
Deputy Director – Dr A.J. Heyns (Director)
Assistant Directors:
(Table Grapes, Horticulture, Plant Improvement, Plant Pathology and Entomology) – Dr A.C. Myburgh;
(Chemistry, Cold Storage, Plant Biochemistry, Fruit Processing, Radio Isotopes) – Dr W.J. Pienaar

REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

LANDBOONAVORSING
AGRICULTURAL RESEARCH

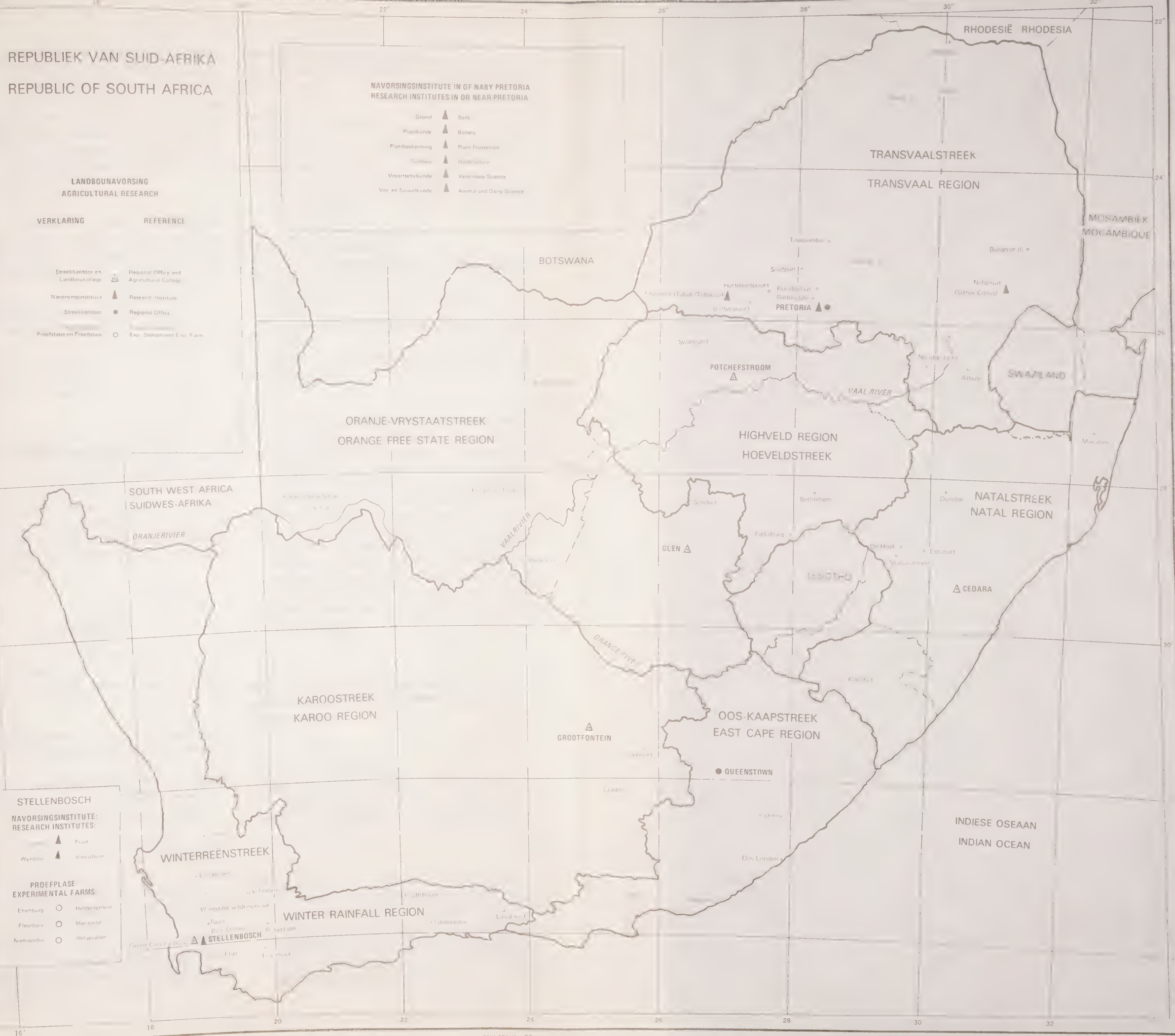
VERKLARING

REFERENCE

- Streekkantoor en Landboukollege Regional Office and Agricultural College
Navorsingsinstituut Research Institute
Streekkantoor Regional Office
Proefstate en Proefplase Exp. Station and Ex. Farm

NAVORSINGSINSTITUUT IN OF NABY PRETORIA
RESEARCH INSTITUTES IN OR NEAR PRETORIA

- Grond Soils
Plantkunde Botany
Plantbeskerming Plant Protection
Tuinbou Horticulture
Veeartsenykunde Veterinary Science
Vee en Suivelkunde Animal and Dairy Science



STELLENBOSCH
NAVORSINGSINSTITUUT:
RESEARCH INSTITUTES:

Wynbou Fruit
Veeartsenykunde Veterinary Science

PROEFPLASE:
EXPERIMENTAL FARMS:

Etterburg Helderfontein
Fleurbaey Mariental
Aelvoord Welgevallen

The Institute is responsible for research on deciduous fruits, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products assigned to it. The Institute further renders a radiation and radio-isotopic service in connection with agricultural problems in the winter rainfall complex.

The Institute controls the research stations and experimental farms at Groot Drakenstein (Bien Donn  ), Citrusdal, De Doorns, Elgin, Langkloof, Paarl and Robertson.

Oenological and Viticultural Research Institute,
Private Bag, Stellenbosch, 7600

Director – Dr J. de V. Burger
Deputy Director – Mr M.S. le Roux
Assistant Director – Vacant

The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The Institute controls the historic wine farm Groot Constantia.

(c) DIVISIONS

Division of Soil Protection

Agriculture Building, Beatrix Street, Private Bag X120, Pretoria, 0001

Director – Dr J. Serfontein
Deputy Director (Regulatory Control) – Mr H.S. Niehaus
Assistant Director (Land Subdivision and Weed Control) – Mr J.H. Cloete
Assistant Director (Administrative) – Mr B.J. Dreyer

The Division is responsible for the administration of the Soil Conservation Act (Act no. 76 of 1969), the Weeds Act (Act no. 42 of 1937), and the Subdivision of Agricultural Land Act (Act no. 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Division of Agricultural Engineering,

Creswell Road, Koedoespoort, Private Bag X515, Silverton, 0127

Director – Mr J.J. Bruwer

Chief Engineers:

(Regional Services and Soil Conservation) – Mr N.J. van Straaten
(Research Civil and Irrigation, Testing and Research Mechanical and Utility Services) – Mr C.T. Crossby

Assistant Chief Engineers:

(Regional Engineering Services, Stellenbosch) – Mr J.F. la G. Matthee
(Soil Conservation Works, Aliwal Noord) – Mr P.J. Pienaar
(Research Civil and Irrigation, Pretoria) – Mr I. Scheepers
(Testing and Research Mechanical, Pretoria) – Mr J. Veenstra

This Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Division of Agricultural Information,

Agriculture Building, Beatrix Street, Private Bag X144, Pretoria, 0001

Director – Mr D.B. Marais
Assistant Director (Information Service) – Mr R.J. van Niekerk, (Deputy Director)
Assistant Director (Publications and Visual Services) – Mr Q. Momberg

The function of the Division is the distribution of agricultural information by mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control (from 1.7.1973)
Agriculture Building, Hamilton Street, Private Bag X179,
Pretoria, 0001

Director – Mr J.F. van Wyk
Deputy Director – Mr D.C. Lourens
Assistant Director (Quality Control) – Mr A.J. Cronje
Assistant Director (Inspection and Control Services –
Mr. L.J. Grobler

The functions of this Division include the protection of
propagation material and the assurance of its
quality. The Division administers the Seeds Act
(No. 28 of 1961), the Plant Breeders' Rights Act
(No. 22 of 1964) and the Agricultural Pests Act
(No. 3 of 1973).

Division of Veterinary Services,
Transvaal Agricultural Union Building, 281 Struben
Street, Private Bag X138, Pretoria, 0001

Director – Dr P.R. Mansvelt
Deputy Directors:
(Regulatory Services) – Dr J.P. van der Merwe
(Pretoria)
(Health Services) – Dr J.H.B. Viljoen (Pretoria)
(Veterinary Services – South West Africa) – Dr T.
Veenstra (Windhoek)

Assistant Directors:
(Animal Health) – Dr P. de la Harpe (Pretoria)
(Diagnostic Services) – Dr G.C. van Drimmelen
(Pretoria)
(Meat Hygiene and Related Matters) – Dr J.D.
Coetzee (Pretoria)
(Import and Export Control and Border Control)
– Dr G.C. Dent (Pretoria)
(Notifiable Diseases, Major Disease Eradication
Schemes, Extension and Training) – Dr A. van
Heerden (Pretoria)
(Bantu Veterinary Services) – Dr J.M. Erasmus
(Pretoria)
(Highveld Region) – Dr P.P. Hugo
(Potchefstroom)
(Natal Region) – Dr W.H.B. Bühr
(Pietermaritzburg)
(Eastern Cape and Karoo Region) – Dr C.W.A.
Belonje (East London)
(Eastern Transvaal Region) – Dr L.R. Hurter
(Pietersburg)
(Transvaal Region) – Dr F.W.B. du Casse
(Pretoria)
(Free State Region) – Dr T.A.T. Louw
(Bloemfontein)
(Winter Rainfall Region) – Dr E.O. le Riche
(Stellenbosch)

(S.W.A. North) – Dr C. van N. Jonker (Windhoek)
(S.W.A. South) – Dr L.J.F. von Maltitz
(Windhoek)

The Assistant Directors of the Regions are under the
direct control of the Director.

The Division has a specific task in regard to animal
health as laid down in the Animal Diseases and
Parasites Act, 1956 (Act 13 of 1956) and
regulations promulgated in terms thereof.

The Division guards against the introduction of diseases
by erecting, patrolling and maintaining game- and
cattle-proof fences on the borders of the Republic
and South West Africa and by controlling animal
imports. For domestic protection regular
inspections of all stock are carried out. The
promotion of animal health schemes to eradicate
certain diseases and animal health in general enjoy
high priority.

Apart from the Central Veterinary Laboratory at
Onderstepoort, the Division also has four Regional
Veterinary Laboratories throughout the Republic
and South West Africa for local investigation of
stock losses, problems relating to animal health
and suboptimal production and reproduction.

In terms of the Animal Slaughter, Meat and Animal
Products Hygiene Act, 1967 (Act 87 of 1967), the
Division is responsible for the promotion and
maintenance of hygiene in cattle slaughterings and
handling of meat and animal products, for
preventing the transmission of diseases to human
beings and animals by disease-infected animals,
meat of animal products, for preventing cruelty to
animals slaughtered at abattoirs and for controlling
the importation of meat.

(e) REGIONAL ORGANISATIONS

The eight Regional Organisations of the Republic, as
well as of South West Africa, are responsible
within their respective geographical areas, for the
planning, development, promotion and application
of farming systems based on optimal land
utilisation.

Each of these organisations provides an extension service
in which the soil conservation effort is integrated
and which also covers every aspect of farming. The
research services are directed to the collation and
releasing of scientific knowledge for the optimal
utilisation of the natural agricultural resources.
The research personnel are also responsible for

specialist extension work and for supplying training services to the agricultural colleges.

number of experiments are also conducted at East London.

Highveld Region,

Private Bag 804, Potchefstroom, 2520

Director – Dr D.J. Agenbach

Deputy Director (Research) – Dr W.P. Grobbelaar
(Assistant Director)

Assistant Director (Research) – Mr J.D. Basson

Deputy Director (Extension) – Dr F.J. Kok

Assistant Director (Extension) – Vacant

Research Stations and experimental farms:

Potchefstroom complex (central research station),
Bethlehem and Swartrand (for gousiekte research)
at Ventersdorp.

Karoo Region,

Grootfontein Agricultural College, Middelburg, 5900

Director – Dr W.J. Hugo

Deputy Director (Research) – Dr P.W. Roux

Assistant Director (Research) – Mr J.A.A. Baard

Deputy Director (Extension) – Mr C.R. Baard

Assistant Director (Extension) – Dr A.J. Siepker

Grootfontein College of Agriculture

Research stations experimental farms: Grootfontein,
Middelburg, C.P. (central research station),
Carnarvon, Tarka Conservation Area and Hales
Flats.

Natal Region,

Private Bag 9021, Pietermaritzburg, 3200

Director – Mr L.C. Zeeman

Deputy Director (Research) – Dr G.O. Harwin

Assistant Director (Research) – Dr J.W.C. Mostert

Deputy Director (Extension) – Mr R.H. Peard

Assistant Director (Extension) – Dr D.M. Scotney

Assistant Director (Administrative) – Mr D.E. Foster

College – Cedara College of Agriculture

Research stations experimental farms: Cedara (Central
Research Institute), Drakensberg Complex,
Northern Natal, Kokstad, Makatini, Pongolapoort
and Ukulinga

Eastern Cape Region,

P.O. Box 233, Queenstown, 5320

Director – Mr L.F. Whitlock

Deputy Director (Research) – Mr J.H. Stapelberg

Assistant Director (Research) – Mr J.L. van der Walt

Deputy Director (Extension) – Mr R.W. Nott (Working
at the Highveld Region)

Assistant Director (Extension) – Dr E. le F. Terblanche
Research stations: Dohne (central research station) at
Stutterheim, and Bathurst (Port Alfred). A

Transvaal Region,

Agrivaal Building, cor. Edmund and Hamilton Streets,
Private Bag X180, Pretoria, 0001

Director – Dr D.M. Joubert

Deputy Director (Research) – Vacant

Assistant Director (Research) – Mr J.J. van der Merwe

Deputy Director (Extension) – Mr E.C. Anderssen
(Assistant Director)

Assistant Director (Extension) – Mr S.J. Gericke

Assistant Director (Administrative) – Mr T. Brenkman

Research stations experimental farms: Roodeplaat
(central research station), Rietondale, Soutpan
(Pretoria); Athole (Amsterdam), Loskop
(Groblersdal), Mara (Louis Trichardt), Messina,
Nooitgedacht (Ermelo) and Towoomba (Warm
Baths).

Free State Region,

Agricultural College, Glen, 9360

Director – Dr S.W. Pienaar

Deputy Director (Research) – Mr W.S. Grobbelaar

Assistant Director (Research) – Dr P.J. Niemann

Deputy Director (Extension) – Dr J.D. Slabber

Assistant Director (Extension) – Mr C.W. Oosthuizen

Assistant Director (Administrative) – Mr G.W.
Long

Glen College of Agriculture

Research stations and experimental farms: Glen (central
research station), Armoedsvlakte (Vryburg),
Koopmansfontein (Barkly West), Rietrivier
(Herbert), Sandvet, Sydenham, Uppington Complex
and Vaalharts (Jan Kempdorp)

Winter Rainfall Region,

J.S. Marais Building, Private Bag X5023, Stellenbosch,
7600

Director – Dr J.E. Erasmus

Deputy Director (Research) – Dr P.J.S. Pieterse

Assistant Director (Research) – Mr J.E. van Niekerk

Deputy Director (Extension) – Mr A. Viljoen

Assistant Director (Extension) – Mr D.J. van Z. Smit

Assistant Director (Administrative) – Mr H.C. du Preez

Stellenbosch-Elsenburg College of Agriculture

Research stations and experimental farms: Elsenburg,
Mariendal and Welgevallen (Stellenbosch),
Langgewens (Moorreesburg), Nortier (Lambert's
Bay), Oudtshoorn, Outeniqua (George),
Tygerhoek (Riviersonderend) and the Veld
Reserve at Worcester

South West Africa,
Private Bag X13184, Windhoek, 9100

Director – Mr D.J. Louw
Deputy Director (Research) – Mr L. Mostert
Deputy Director (Extension) – Mr J.H. Loubser

Neudam Agricultural College
Research stations experimental farms: Gellap 'Ost
(Keetmanshoop), Hardap (Mariental), Kalahari
(Stampriet), Neudam (Windhoek), Omatjenne
(Otjivarongo), Sandveld (Gobabis), Sonop
(Grootfontein) and Uitkomst (Grootfontein).

(2) FINANCES

(a) REVENUE (REPUBLIC)

	R	R	R
1. Rentals from houses			163 661,26
2. Interest			11 515,93
3. Recoveries of loans			976 880,41
4. Departmental receipts			
Administration and general			
(a) Registration fees	174 473,49		
(b) Commission on insurances	8 399,31	182 872,80	
Vaccines		1 207 325,81	
Goods and services		939 427,54	
Publications		22 458,72	
5. Miscellaneous revenue			
(a) Refund on voted expenditure	500 333,01		
(b) Sale of State property	253 074,96		
(c) Unclaimed cash	6 120,47		
(d) Miscellaneous	239 570,51		
GRAND TOTAL		990 098,95	3 342 183,82
6. Interest of Tobacco Research Account			15 025,73
7. Interest on Wine Research Account			1 742,78
8. Interest on Agricultural Research Account			2 389,47
TOTAL REVENUE			4 513 399,40

(b) REVENUE (SOUTH WEST AFRICA)

	R	R
1. Rental from houses		
2. Departmental receipts		
Vaccines		
Goods and services		
Publications		287 880,22
3. Miscellaneous revenue		
TOTAL REVENUE		287 880,22

(c) EXPENDITURE (REPUBLIC)

	Vote	Expenditure
	R	R
Salaries, allowances, etc.	23 945 000	26 096 430,00
Subsistence and transport	3 600 000	3 278 603,32
Postal services	347 000	398 226,64
Printing	670 000	469 757,69
Miscellaneous	544 000	504 688,91
Plant Protection	101 000	77 195,29
Animal and Dairy Science	488 000	390 952,11
Tobacco	50 000	42 413,89
Soil and Irrigation	92 000	75 738,29
Horticulture	36 000	34 525,60
Citrus and Subtropical Fruit	140 000	117 694,61
Fruit and Fruit Technology	126 000	123 014,69
Botany	47 000	42 817,59
Oenology and Viticulture	74 000	68 305,68
Veterinary	690 000	563 149,83
Veterinary Field Services	1 246 000	1 116 097,88
Plant Pest Control	175 000	296 687,84
Agricultural Information	76 000	77 541,93
Agricultural Engineering	780 000	527 740,58
Seed Control	21 000	11 114,83
General Maintenance Cost		
Original appropriation .. 630 000		
Additional appropriation 50	630 050	549 543,71
Soil Conservation	14 994 000	12 113 775,47
Agricultural Research Stations	528 000	438 270,11
Agricultural Scholarships etc.	537 500	531 762,92
Minor works	276 000	176 298,37
TOTAL EXPENDITURE	50 213 550	48 122 347,78

(d) EXPENDITURE (SOUTH WEST AFRICA)

	Vote	Expenditure
	R	R
Salaries and allowances, etc.	1 707 000	1 575 625,93
Subsistence and transport	701 000	663 145,87
Postal services, etc.	20 000	20 539,01
Printing	17 000	10 702,55
Miscellaneous	19 000	13 586,90
Agriculture	41 000	24 525,71
Veterinary	509 000	292 565,41
Soil Conservation	3 335 000	3 255 234,43
Agricultural Experiment farm	196 000	168 246,12
Minor works	7 000	4 603,92
TOTAL EXPENDITURE	6 552 000	6 028 775,85

(3) BUILDINGS

(a) Major constructions completed

Pretoria: Onderstepoort — Changing of hospital into laboratory	R34 800
Pretoria: Roodeplaat — Additions to wheat research building	R54 864

(b) Major constructions in hand

Stellenbosch: Fruit and Fruit Technology Research Institute — Additions to radio isotope building	R53 657
Irene: Administration Building at the Animal and Dairy Science Research Institute	R1 050 000

(4) SCIENTIFIC PUBLICATIONS

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- KARSTEN, J.H.M. & HAASBROEK, F.J.,* 1973. A new method of calibrating a neutron moisture meter and a correction for the effect of soil bulk density. *Agrochemophysica* 5, 35–40.
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Series: The cultivation of vegetables in South Africa VIII

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- A.1 Mushroom growing for the amateur — Gorter, G.J.M.A.
- A.2 Commercial mushroom growing — Gorter, G.J.M.A.

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(7) NEW LEGISLATION

The following acts were approved by Parliament during the year under review:

- 8/74 – Subdivision of Agricultural Land Amendment Act, 1974
- 9/74 – Veterinary Amendment Act, 1974
- 11/74 – Soil Conservation Amendment Act, 1974